RAND

Work Plan for an Inpatient Rehabilitation Prospective Payment System

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PREFACE

This work plan describes research to support the Health Care Financing Administration's (HCFA) design, development, implementation, monitoring, and refining a Prospective Payment System (PPS) for inpatient rehabilitation. Such a rehabilitation PPS (or RPPS) was mandated in the Balanced Budget Act of 1997.

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1. INTRODUCTION

OVERVIEW AND SURVEY OF PREVIOUS RESEARCH

In the Balanced Budget Act of 1997, Congress mandated that the Health Care Financing Administration (HCFA) implement a Prospective Payment System (PPS) for inpatient rehabilitation. This work plan describes the research that we intend to support HCFA's efforts to design, develop, implement, monitor, and refine such a PPS.

This rehabilitation PPS, which we will call the RPPS, will apply to rehabilitation hospitals and to distinct rehabilitation units of acute care hospitals that were excluded from the acute PPS. In order to qualify for such an exclusion the rehabilitation facility must meet two conditions. First, all Medicare patients generally receive at least three hours of therapy per day. Second, 75 percent of all patients must have one of 10 specified problems related to neurological or musculoskeletal disorders or burns.

Payment for inpatient care of Medicare beneficiaries given in a rehabilitation facility is currently made under the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982. The payment amount depends on a per-case target amount that is calculated from historical costs at the facility trended forward and on the hospital's actual cost per case. Under TEFRA, there is no adjustment for changes in a hospital's case mix and new hospitals were able to obtain larger payments than existing hospitals. The BBA introduced interim changes to the payment system designed to reduce HCFA's costs and to mitigate the advantage that new hospitals had under the TEFRA payment system. In particular, limits were set on the payment rate for new hospitals and separate maximum payment limits for all hospitals were created. In addition, hospitals that were receiving Medicare payments prior to FY 1990 were allowed to request rebasing of their target costs.

The new RPPS will be implemented beginning with each hospital's fiscal year beginning on or after October 1, 2000. In the first two years of the RPPS, the hospital's payment rate will be a blend of the national PPS payment and its TEFRA payment. In the first year, the national RPPS payment will account for one-third of total payment and in the second year for two-thirds of payment. A fully national prospective payment will be used for all cost report periods beginning on or after October 1, 2002.

Need to Improve Payment

Technological changes in the process of care and greater availability of post acute care combined with financial incentives to cause rapid growth in Medicare payments for all forms of

post acute care, including rehabilitation. The number of Medicare beneficiaries served by Skilled Nursing Facilities (SNFs) grew by 94 percent from 1990 to 1995, Medicare beneficiaries served by Home Health Agencies by 78 percent, and the number of Medicare discharges from rehabilitation facilities by 67 percent. (MedPAC, July 1998, Charts 4-3, 4-8, and 4-17). Acute hospitals, paid under the acute PPS, find it advantageous to transfer patients to a different setting as soon as possible. Probably affected by both PPS and TEFRA incentives, the number of rehabilitation hospitals and units increased 4.1 percent annually during 1990-1997 (MedPAC, July 1998). By FY 1996, 23 percent of acute PPS discharges used post acute care within one day of discharge and 2.8 percent went to a rehabilitation facility.

Although rehabilitation facility payments from Medicare were substantially less than costs in the early 1990s, the ratio of aggregate Medicare payments to cost increased rapidly during the last decade. By 1995 payments exceeded costs by 7 percent for free-standing rehabilitation hospitals and by 4 percent in rehabilitation units. (MedPAC, July 1998, Chart 4.17). This improved position was driven, at least in part, by reduced costs associated with a substantial decline in length of stay (LOS) for rehabilitation patients.

In addition to TEFRA's inability to control costs, it may hinder access to care. The lack of a case mix adjustment in TEFRA creates incentives for providers to specialize in relatively cheaper cases, which could conceivably limit beneficiary access. Further, TEFRA lacks outlier payments that help to mitigate the acute PPS's incentives to under serve the most expensive patients and that provide substantial protection to providers against financial risk (Keeler, Carter, and Trude, 1988). Additional distortion of case-level payments occurs when TEFRA counts discharges that do not include a full course of rehabilitation (e.g., short stays for evaluation, cases that transfer to acute care) as full cases. These distortions may have both quality and cost control incentives.

Further, TEFRA is widely perceived to be unfair to hospitals. Newer hospitals were not subject to the same incentives for efficiency, and indeed were rewarded for incurring higher costs in their base year(s).

Research Enabling an RPPS

One of the reasons for the initial exclusion of rehabilitation hospitals from the PPS was that Diagnosis-related- groups (DRGs) could not predict resource use at these facilities very well. Functional status, measured by activities of daily living and mobility, is much more correlated than diagnoses with charges for the patient (Hosek et al., 1986). Restoring functional status is the goal of rehabilitation and thus functional status at admission is one of the primary determinants of resource use.

In the early 1990s Margaret Stineman and colleagues developed Function Related Groups (FRGs) based on the Functional Independence Measure (FIM) as well as on a clinically derived set of rehabilitation impairment categories (RICs) (Stineman, Escarce, et al., 1995). The FIM is an 18-item measure covering six domains: self-care, sphincter control, mobility, locomotion, communication, and social cognition (Stineman, Hamilton, et al., 1994).

Carter, Relles, et al. (1997) evaluated the FIM-FRGs and found that FIM-FRGs use the right organizing concepts for a rehabilitation patient classification system—impairment groups subdivided by functional status and age. The study found further that they are good predictors of resource use. The analysis suggested that the FIM-FRGs could be a suitable basis for an RPPS, but that certain modifications would produce even better groups for payment purposes. In particular they advised using a multiplicative factor to account for the extra costs associated with patients who have at least one of a selected set of major comorbidities and expanded the FRG set to 82 FRGs. In expanding the number of FRGs, they changed the stopping algorithm to limit the number of categories in the classification system.

Carter, Buchanan, et al. (1997) describes the construction of a model of an RPPS based on these expanded FRGs and comorbidity weights. They examined the major elements of such a system: case weights, payment arrangements for unusual cases such as transfers and outliers, hospital-level payment adjustments, and a monitoring system. They examined alternative forms of several of these payment elements in payment simulations. They concluded that an RPPS based on the FIM-FRGs is feasible and could achieve several goals. The RPPS provides hospitals with incentives for efficiency because they can keep payments in excess of costs. It disadvantages no clinical or demographic group, and therefore should promote access for all Medicare beneficiaries to high quality and appropriate care. The model RPPS was judged fair to hospitals since it distributes Medicare payments according to patient characteristics modified by input prices and covers costs at all groups of hospitals except those who probably have high costs because they have especially high payments under the current payment system.

Survey Instrument for Post Acute Care

In developing a case-based RPPS for rehabilitation facilities, one must be mindful of the relationship between the PPS and payment for rehabilitation that occurs in other sites—particularly in SNFs and HHAs. The increase in Medicare post acute care costs led to a demand to reform all payment for post acute care. The same BBA that mandated a PPS for rehabilitation hospitals, also mandated the use of PPSs for SNFs starting in July 1998 and for HHAs starting in October 1999. Further, HCFA must prepare a report to Congress on a PPS for long-term care hospitals.

There is some overlap in the populations seen in these sites (Kramer et al., 1997), and using different payment systems in different sites may lead to inappropriate sorting of patients leading to undesirable clinical and fiscal consequences. Consequently, HCFA has invested in the development of a patient level survey instrument, called the Minimum Data Set- Post Acute Care or MDS-PAC. The intent is that this instrument will be used for all post acute care patients, allowing comparability of case mix and outcomes across settings. This instrument has been pilot tested across all post acute care settings, including rehabilitation.

OVERVIEW OF WORK PLAN

Approach

We will build on work done on the FIM, the FRGs, the model RPPS, and the MDS-PAC. The design of the RPPS that we produce here will differ from earlier RAND work on design of an RPPS by restricting the design and evaluation of payment elements to Medicare patients in rehabilitation hospitals. We will replicate many of the earlier analyses with later data from more hospitals. Further, we intend to extend the earlier RAND work by more detailed consideration of several payment elements (notably comorbidities and hospital-level adjustments) and by much more attention to implementation issues, including evaluation and monitoring.

The criteria for the design and development of the RPPS will be similar to those used in Carter, Buchanan, et al. (1997). To insure access to quality care for all Medicare patients, the system must identify patient groups who need different levels of resources and then pay for each group in proportion to cost. The system should be fair to hospitals by paying for costs, such as area wage levels, or a population that is disproportionately poor, that are outside the control of hospital administrators. It must allow HCFA to control its budget for post acute care. The payment system must provide incentives for hospitals to provide quality care and limit incentives for "gaming".

Payment System Elements

The unit of payment in the RPPS will be all hospital services beginning with the admission to the rehabilitation hospital or unit and ending with discharge from that facility. Rehabilitation stays are episodic: they typically begin with acute care and the majority end with a return to independent living in the community. Indeed, return to the community is the stated goal of the inpatient rehabilitation process.

Each case will be classified using a version of FIM-FRGs defined solely on Medicare patients in rehabilitation hospitals and units. The FIM-FRGs will be assigned based on information in the MDS-PAC, with that instrument modified as needed to accommodate the classification rules for FRGs. The payment will account for patient-level variation in need for rehabilitation resources as measured by weights assigned to each combination of FRG and Comorbidity status (FRGC). Payments will be further adjusted based on hospital characteristics that affect costs. Finally, special payments will be used for unusual cases.

We will also present options regarding the design and development of a monitoring system. The system must monitor performance at the level of the individual hospital, the rehabilitation market, and the post acute care market, as well as nationally. The intent of monitoring at the market and national level is to learn quickly about any unintended consequences of the RPPS so HCFA can promptly refine the RPPS. Monitoring at the hospital level will be designed to discourage gaming as well as to ensure quality care and appropriate payments. The monitoring system will measure access, payments, quality of care, and cost. It will identify the effects of the rehabilitation payment system and other changes in the health care market on rehabilitation facilities and on other post acute care providers.

Data and Methods

The initial design and development of the RPPS will be based on a merged file of discharge abstracts from HCFA (the MEDPAR file) and abstracts containing FIM data from both UDSmr and Caredata.com. In considering implementation, we will account for information available on the draft of the MDS-PAC and, if necessary, make recommendations for changing the instrument and/or instructions for filling out the instrument. Further, we will consider how the system might be refined to use the additional information that will become available once the MDS-PAC (Version I) is used uniformly by rehabilitation facilities and by other post acute care providers.

We will convene a Technical Expert Panel (TEP) consisting of experts in rehabilitation for the elderly, classification systems, and/or payment systems. We shall use the panel to review the preliminary design work to be reported in our interim report and to review our final report.

OVERVIEW OF REPORT

Section 2 of this report describes our data, including descriptive statistics and an assessment of the extent to which our FIM data are representative of the Medicare population. Section 3 gives the definition of the primary variables used in multiple analyses. Other

variables are defined in the sections where they are used. Sections 4 through 7 cover the elements of an RPPS: the classification system, weights, facility-level adjustments, and patient-level adjustments, respectively.

A simulation program will be used to examine the joint performance of all the RPPS elements. These simulations assume no behavioral response by hospitals to the RPPS. The simulation methods are presented in Section 8. Sections 9 and 10 describe analyses related to implementation issues and monitoring.

In writing sections 2 through 10, we concentrate on the logical needs of the analysis and ignore the difficulties introduced by the constraints required to implement the RPPS according to the BBA schedule. These constraints are addressed in the final section of the work plan. Section 11 provides a schedule for all activities that will allow implementation of the RPPS to begin on October 1, 2000.

2. CASE MIX DATA

The Health Care Financing Administration (HCFA) contracted with RAND for a file construction project in September 1998 in order to support the development of a Medicare rehabilitation care prospective payment system (RPPS). The files that were constructed under this project link data collected by rehabilitation hospitals on the functional status of their patients with standard inpatient Medicare files. They are the primary source of data for this research project to further develop the RPPS. The data will be used to develop a case-level classification system that underlies payment, to describe the case mix at rehabilitation facilities, to develop payment parameters, and to support simulations that evaluate the impact of the payment system.

This section of our work plan documents the steps taken to build those files. Three data systems were the primary sources for our efforts:

1. Medicare program information--the Medicare data files include discharge files recording demographic, clinical, and financial information, and hospital-level files providing facility characteristics and financial information.
2. The Uniform Data System for medical rehabilitation (UDSmr). UDSmr provides functional status and demographic information for rehabilitation discharges from participating hospitals.
3. The Medical Outcomes System (MOS) data for medical rehabilitation from Caredata.com. MOS also records functional status and demographic information for rehabilitation discharges from participating hospitals.

We linked records from the Medicare Provider Analysis and Review (MEDPAR) and UDSmr/MOS files that described the same discharge. Then, we assessed the quality of the linking process, both in terms of what percentage of cases we were able to match, and the degree to which the linked sample represents the population potentially impacted under RPPS.

We describe our data sources in the next subsection and then the linking process, which proceeded in two steps. The first step determined the Medicare provider number(s) corresponding to each UDSmr/MOS facility code. The second step matched UDSmr/MOS and MEDPAR patients within paired facilities. Finally, we describe the quality of the resulting match, including the extent to which the linked MEDPAR and UDSmr/MOS records are representative of the MEDPAR universe. An appendix to this section provides details of the match algorithm we used.

DATA SOURCES

Medicare Data

We used two Medicare data files. The MEDPAR file describes all inpatient stays (including rehabilitation stays) paid for by Medicare, and the Health Care Provider Cost Report Information System (HCRIS) provides facility information at the hospital and exempt unit level.

The MEDPAR file contains one record for each discharge (including discharges from rehabilitation facilities) paid by Medicare. We used the 1996 and 1997 calendar year MEDPARs. The data include patient demographics (age, gender, race, residence zip code), clinical characteristics (diagnoses and procedures), and hospitalization characteristics (admission date, discharge date, days in intensive-care wards, charges by department, and reimbursement information).

Hospital cost reports are contained in HCRIS. The cost report files contain information on facility characteristics, utilization data, and cost and charge data by cost center. Each record covers a hospital fiscal year, and all the hospital fiscal year records that began during a specific federal fiscal year are kept together in the same file. The file is named according to the number of years from the beginning of the acute-care Medicare Prospective Payment System (PPS). We used the latest available file--PPS13 (i.e., hospital fiscal years that began during FY 1996 from 10/1/95 through 9/30/96). Thus, the cost report data coincide well with the calendar year 1996 MEDPAR data, but they cover a somewhat earlier time period than the 1997 MEDPAR data, with the time difference varying by provider--from 15 months (for hospitals whose fiscal year begins on October 1) to, typically, six months (for hospitals whose fiscal year begins July 1).

Table 2.1 shows the original size of the MEDPAR files for 1996 and 1997. There are over 12 million records per year. We are interested in a subset of these records: cases paid by Medicare as rehabilitation stays that were exempt from PPS. Table 2.2 shows total 1996 and 1997 rehabilitation stays, by type of provider (free-standing rehabilitation hospital versus exempt unit of an acute care hospital). MEDPAR contains sufficient information to identify such provider types (see note to Table 2.2), and this will be a useful distinction for subsequent analytical work.

Table 2.2 describes the population to which RPPS payments would have applied in 1996 and 1997 (referred to hereafter as "patients eligible for RPPS"). We think of this as our "sampling" frame. In order to describe the rehabilitation case mix, we want to attach rehabilitation stay information from UDSmr or MOS to each record in this frame, thereby obtaining "complete" records. To the extent that we cannot add information to some records,

we will want to know how and whether to weight the complete records so they will reflect the composition of the frame.

Table 2.1

Number of Total MEDPAR Cases and Hospitals

Calendar Year	Number of Cases	Number of Hospitals
1996	12,231,275	6,339
1997	12,263,463	6,257

Table 2.2

Number of Rehabilitation MEDPAR Cases and Facilities

	Number of Cases			Number of Facilities		
Calendar Year	Total	Free-Standing	Exempt Units	Total	Free-Standing	Exempt Units
1996	344,126	114,933	229,193	1,081	204	877
1997	359,032	118,541	240,491	1,123	212	911

Note: Free-standing facilities have characters 3-6 of the Medicare provider number in the range 3025-3099. Patients receiving rehabilitation care in exempt units of acute care hospitals have a "provider code" of T in their MEDPAR records.

UDSmr and MOS Data

Both UDSmr and MOS describe rehabilitation stays in participating hospitals. The data include demographic descriptions of the patient (birth date, gender, zip code, ethnicity, marital status, living setting), clinical descriptions of the patient (condition requiring rehabilitation, ICD-9-CM diagnoses, functional independence measures (FIM) at admission and discharge), and the hospitalization (encrypted hospital identifier, admission date, discharge date, charges, payment source, and an indicator of whether this is the first rehabilitation hospitalization for this condition, a re-admission, or a short stay for evaluation). UDSmr is operated within the Center for Functional Assessment Research, U. B. Foundation Activities, Inc. MOS is operated by Caredata.com, Inc., a provider of health care data and decision support systems, located in Atlanta Georgia. Participation in either of these databases is entirely a voluntary decision by hospital management. Hospitals that are not participating in either database may be using a different version of the FIM, a different assessment instrument, or not participating in any assessment process.

We obtained data (which we call "FIM" data) from the UDSmr and Caredata.com data systems for calendar years 1996 and 1997, as shown in Table 2.3.

Table 2.3
Numbers of FIM Records and Facilities

Calendar Year	Source	Number of Records	Number of Facilities
1996	UDSmr	225,069	533
	MOS	44,478	159
1997	UDSmr	258,915	595
	MOS	67,350	164

We note that these data do not provide a complete record of activity at these facilities during those years. Many hospitals were joining UDSmr or MOS during 1996 and 1997, so may have been present only part of the year, or may not have had their data properly organized to include in the data systems until somewhat later. Also, some hospitals belonged to both UDSmr and MOS. Finally, the files cover segments of the population that are not of interest here: non-Medicare patients, Medicare patients paid through the acute PPS, and patients in skilled nursing facilities and long term care hospitals.

Based on the description above, the FIM records would have to be described as incomplete in unknown ways, a not very satisfactory status. We will remedy this situation below when we describe the correspondence between the records we were able to link to MEDPAR records and the entire frame.

MATCHING MEDPAR AND FIM FACILITIES

The first step in the matching process is to link MEDPAR to FIM facilities. The FIM files arrived grouped by facility, but linking FIM identifiers to MEDPAR provider numbers proved difficult because the FIM identifiers were frequently encrypted. Even when not encrypted, we could not entirely trust the provider number used by the facility because there have been many changes in provider numbers and names over time due to reorganizations, purchases, and mergers. Provider numbers that did not appear in the Medicare cost report (HCRIS) files as rehabilitation hospitals or exempt units were candidates for review.

Our main method for constructing the facility groupings was to consider all possible MEDPAR and FIM combinations for each year (e.g., 6,339 x 692 = 4,386,588 combinations in 1996). For each of these combinations, we counted the number of exact matches of MEDPAR and FIM records based on admission date, discharge date, and zip code. We considered for further review the candidate pair with the largest number of matches. We observed that there was almost always a candidate pair with the number of matches equal to a substantial fraction of its total number of records, with each member of the pair having at most one or two matches

with a few other providers. Selecting pairs with 10 or more matches seemed a sensible pairing rule. We confirmed that this rule worked very well with UDSmr facilities, where the provider number was often not encrypted.

In some cases, the 10 or more matches rule suggested multiple links, which we knew was a possibility due to changes occurring during 1996 and 1997. For MOS, we also identified several skilled nursing facilities, which we removed from our sample. Table 2.4 summarizes the results of this stage of the linking process. The number of facilities represented in our FIM datasets turned out to be slightly more than half of all rehabilitation hospitals.

Table 2.4

Numbers of FIM Facilities Linked to MEDPAR Providers

Calendar Year	Source	MEDPAR Unique Providers (a)	MEDPAR Multiple Providers (b)	Non-Rehab Providers(c)	Total
1996	UDSmr	501	10	22	533
	MOS	67	8	84	159
1997	UDSmr	557	15	23	595
	MOS	68	18	78	164

Notes: (a) FIM facilities which appear to have a single MEDPAR provider. (b) FIM facilities which appear to have more than one MEDPAR provider. (c) FIM facilities which appear to be SNFs or long-term care hospitals.

MATCHING FIM AND MEDPAR RECORDS

We attempted to match each MEDPAR record from a hospital participating in UDSmr or MOS to a corresponding FIM record. The FIM data do not contain the Medicare beneficiary identifier, and therefore we needed to use a probabilistic matching algorithm based on characteristics of the beneficiary and the hospitalization. The matching was accomplished in a series of four steps:

1. identify match variables;
2. clean up the FIM files, re-coding certain FIM variables to be consistent with MEDPAR, creating additional records for UDSmr interrupted stays, and eliminating duplicate cases;
3. run a match algorithm to link FIM and MEDPAR records; and
4. choose a single MEDPAR case if it matches multiple UDSmr or MOS cases.

Identify Match Variables

Given the results of our provider linking process, we searched for matches only within the provider number and facility identifier pairings. For free-standing hospitals we attempted to match all MEDPAR records to a UDSmr record. For acute-care hospitals, we cared about matching only records that had a provider code of "T" (which indicates that the case was cared for in a rehabilitation unit exempt from the PPS). However, we allowed non-"T" records to compete for matches so as to siphon off FIM records that otherwise would have a chance of incorrectly being paired with a "T" record.

For MEDPAR, in addition to hospital identity, we used six variables to link the records: admission date, discharge date, zip code, age at admission, sex, and race. For UDSmr/MOS, we had the same information in a slightly re-coded form (e.g., birth date). We also had an indicator of whether Medicare was the primary payer, which helped us judge how to set certain parameters of our matching algorithm.

Clean Up FIM Files

For UDSmr, it was necessary to create additional records for interrupted stays. For both UDSmr and MOS, it was necessary to eliminate some duplicates.

Interrupted stays occur when the patient's rehabilitation treatment is interrupted by an acute-care hospitalization and the person returns to the rehabilitation facility within 30 days after leaving the rehabilitation facility. Typically, Medicare data treat an interrupted stay with a single acute-care hospitalization as two rehabilitation discharges, an interrupted stay with two acute-care hospitalizations as three rehabilitation discharges, etc. MOS's coding of interrupted stays is similar to Medicare's: one record per rehabilitation episode, so there was nothing additional to do there. UDSmr, however, codes multiple stays via a series of "transfer/return" dates on a single UDSmr record. To facilitate matching UDSmr and MEDPAR records, we created multiple records for interrupted stays, with admission and discharge dates corresponding to the beginning and ending of each stay. The additional records were then given the same chance of matching MEDPAR records as any non-interrupted stay.

For both UDSmr and MOS files, there were some duplicate cases. We were first alerted to this problem by observing that there were some exact matches on all of the candidate MEDPAR matching variables and that the functional status measures were identical on each of the matched records. We investigated further and found that matching on admission date, discharge date, and date of birth perfectly flagged what appeared to be the same person. We prioritized the retention of duplicate cases as follows: presence of complete information first, interrupted stay second, Medicare as the primary payer third, and onset date preceding

admission date last. We next checked whether the records were similar on functional status measures. In Carter and Relles (1997), we had developed rules for determining "function related groups" (FRGs), within which resource use and clinical diagnosis were fairly homogeneous. We applied these rules to the candidate duplicate pairs, and found that 91.2 percent of the duplicate cases would have had the same FRG assignment. Because of this high agreement rate, and also because the percent of duplicates is only .5 percent to start with, we are convinced that these records could not have a measurable impact on our analysis.

Table 2.5 shows the number of records present at the various stages of cleanup. The last column shows the number of cases that we would be attempting to match to MEDPAR.

Table 2.5

Number of FIM Records At Various Stages of Cleanup

Calendar Year	Source	Number of Records		
		Original	Adjusted for Interrupted Stays	Duplicates Eliminated
1996	UDSmr	225,069	232,076	231,003
	MOS	44,478	44,478	44,375
1997	UDSmr	258,915	267,444	266,288
	MOS	67,350	67,350	67,082

Matching Discharges from MEDPAR and FIM Files

We ran a match algorithm similar to the one used in Carter, Relles, et al. (1997). The methods assume that links are imperfect--any variable can be in error. A scoring function is developed, based on Bayes' Theorem, which gives the odds of a match based on how consistent variables tend to be for true matching and non-matching cases. Scoring functions, described in Appendix A, were derived for each of the four combinations of files: UDSmr and MOS, for 1996 and 1997.

Running the algorithm entailed the following steps separately for each of the four files:

1. take each provider number/facility pairing identified using the methods of Section III. If a FIM facility is linked to more than one MEDPAR provider, or one MEDPAR provider links to more than one FIM facility, include all of the potential pairings.
2. within each facility pairing, consider all combinations of case-level pairings, and compute the match score according to the algorithm shown in Appendix A. If N is the number of MEDPAR cases, and K is the number of FIM records, this means consider N x K pairs.
3. sort the N x K pairings descending by score, and select the pair with the highest match score.

4. eliminate the pair just selected from further consideration, and repeat the previous step until all (the minimum of N and K) cases are paired.

Additional analysis of scores was performed to see at what cutoff level do we tend to not get close seconds, and at what point to we tend to get Medicare as a primary payer (that information was recorded in both UDSmr and MOS). At present, we believe that 2.0 or above has a high probability of identifying a match. The match statistics we report in Table 2.6 below assume that cutoff; in fact, we intend to carry the match score through some of our analyses, and examine the effect of varying the threshold parameter.

Table 2.6

Number of FIM Records Linked to MEDPAR

Calendar Year	Source	Input to Match Algorithm	Linked and Cutoff Score ≥ 2.0
1996	UDSmr	231,003	163,509
	MOS	44,375	27,664
1997	UDSmr	266,288	185,567
	MOS	67,082	42,129

Note: the large drop in records at this point is explained by the FIM files carrying records for all patients, without regard to Medicare status. Also, several skilled nursing facilities were included in MOS but had no MEDPAR matches.

Choose a Single MEDPAR Case for Multiple FIM Matches

While the matching was unique within a facility/provider pair, some MEDPAR providers were paired with more than one facility, which meant that a MEDPAR case could be matched to multiple records (each in a different facility). Also, some UDSmr and MOS facilities were the same: 6 overlaps in 1996, 7 in 1997.

Both of these situations necessitated additional duplicates elimination steps. We eliminated MEDPAR duplicate links within each file first, then between UDSmr and MOS within year. In all cases, we kept the cases with highest scores. Results are provided in Table 2.7 for cases with cutoff scores ≥ 2.0.

Table 2.7
Number of Linked Records After Duplicates Elimination

Calendar Year	Source	Multiply Paired Providers (a)	Number of Records, Cutoff Score ≥ 2.0		
			Total Linked Records	Duplicates Eliminated (b)	Overlap Eliminated (c)
1996	UDSmr	5	163,509	162,850	162,692
	MOS	5	27,664	27,630	26,197
1997	UDSmr	8	185,567	184,431	183,960
	MOS	10	42,129	41,980	38,722

Note: (a) Number of MEDPAR providers paired with more than one FIM facility. (b) Multiple pairings can link the same MEDPAR record to more than one FIM case. This step eliminates those multiple links, keeping the link with the highest match score. (c) The same MEDPAR provider might show up in both UDSmr and MOS, again allowing the same MEDPAR record to match more than one FIM case. This step eliminates those multiple links, keeping the link with the highest match score.

QUALITY OF THE MATCH

There are two aspects to evaluating the quality of the match. The first is whether we actually matched all of the cases. Given the inevitable errors and holes in the data, is there a large block of cases that we expected to match that were not matched? To answer this question, we compute match rates for each of our populations: UDSmr, MOS, and MEDPAR. Second, given that the matched file will be the basis of an RPPS impact analysis, is it representative of the entire population? To answer this question, we compare patient and hospital characteristics of the linked and full population, and consider whether some form of weighting would make those populations look sufficiently the same.

Match Rates

Because several FIM facilities provided less than a full year of data, it would be misleading to simply tabulate the fraction of MEDPAR cases within FIM facilities that achieved a match. Table 2.8 adjusts for this by displaying match rates for MEDPAR providers with matches at the same FIM facility for a full year. The table suggests overall match rates in these FIM facilities for the eligible RPPS population to be almost 90 percent. This was slightly higher than expected--the Carter, Relles, et al. (1997) match rates were about 86 percent.

Table 2.8
MEDPAR Match Rates for Providers with a Full Year of Data

Year	Source	Number of MEDPAR Cases	Number of Matched Cases	Percent of MEDPAR Cases Matched
1996	UDSmr	155,502	136,056	87.5
	MOS	7,157	6,354	88.8
1997	UDSmr	175,807	156,520	89.0
	MOS	36,774	33,549	91.2

Another way to look at the quality of the match is to examine the proportion of FIM records that match to the MEDPAR. The FIM files contain many cases not paid by Medicare, but the files provide an indication of whether Medicare is the primary payer. Restricting our attention to just these cases, we obtain the percentages shown in Table 2.9.

Table 2.9
FIM Match Rates for Medicare as Primary Payer Cases

Source	Year	Number of FIM Cases	Number of Matched Cases	Percent of FIM Cases Matched
UDSmr	1996	160,125	153,926	96.1
	1997	179,179	171,885	95.9
MOS	1996	28,767	26,857	93.4
	1997	44,172	41,168	93.2

These match rates are also slightly higher than reported in Carter and Relles (1997), where a 93.7 percent rate was achieved for 1994 UDSmr data.

Given that the data are recorded with errors, and that hospital reporting to UDSmr or Caredata.com is discretionary (having no bearing on reimbursement), we consider these match rates to be acceptable. We do not believe there is anything we can do, within the limitations of information available, to achieve higher rates.

REPRESENTATIVENESS OF LINKED MEDPAR

We next address the extent to which the hospitals present in the FIM file are representative of the set of all hospitals that provide inpatient rehabilitation care to Medicare beneficiaries, and the extent to which FIM RPPS-eligible patients are representative of all Medicare RPPS-eligible patients. This analysis reflects the effects of the partial-year sample available in some FIM hospitals as well as the sampling of hospitals.

For analytical purposes, lack of representativeness is most important for characteristics that are related to outcomes we are trying to model. For example, if costs for treating a patient

in a free-standing hospital differed from costs in exempt unit of acute care hospitals, we would consider re-weighting the sample of linked cases to adjust our total cost estimates.

Representativeness of Hospital Characteristics

The linked MEDPAR records contain data from over 1,000 inpatient hospital facilities in each year. Table 2.10 divides these hospitals into free-standing and exempt rehabilitation units of acute-care hospitals. It presents the number of hospitals with rehabilitation cases in our linked MEDPAR sample, along with the total MEDPAR counts of rehabilitation patients at these hospitals.

Table 2.10
Comparison of Number of FIM and MEDPAR Rehabilitation Facilities, by Type of Hospital

	1996			1997		
	Number of Rehabilitation Hospitals			Number of Rehabilitation Hospitals		
Type of Hospital	FIM (a)	MEDPAR	Percent of MEDPAR Hospitals	FIM (a)	MEDPAR	Percent of MEDPAR Hospitals
Free-standing	130	204	64	142	212	67
Exempt unit	435	877	50	489	911	54
Total	565	1081	52	631	1123	56
	1996			1997		
	Number of Rehabilitation Cases (b)			Number of Rehabilitation Cases (b)		
Type of Hospital	FIM (a)	MEDPAR	Percent of MEDPAR Cases	FIM (a)	MEDPAR	Percent of MEDPAR Cases
Free-standing	86,301	114,933	75	94,327	118,541	80
Exempt unit	130,623	229,193	57	150,787	240,491	63
Total	216,924	344,126	63	245,114	359,032	68

Note: (a) Hospitals with at least one linked MEDPAR/FIM rehabilitation record. (b) Total (matched + unmatched) rehabilitation cases.

As shown in Table 2.10, FIM data slightly overrepresent free-standing rehabilitation hospitals and slightly underrepresent exempt units. The table also indicates UDSmr/MOS's tendency to include larger hospitals. In 1997, FIM hospitals represented 56 percent of the hospitals, but served almost 70 percent of all MEDPAR rehabilitation hospital cases. From the table, one can calculate that, in 1997, FIM free-standing hospitals had an average of 792 patients, 532 more than other-MEDPAR free-standing hospitals, and FIM exempt units had an average of

365 patients, 185 more than other-MEDPAR exempt units. Table 2.11 shows the distribution of FIM hospitals by size. This confirms that free-standing hospitals are larger than exempt units, and shows that FIM hospitals tend to be larger than other-MEDPAR hospitals within type of hospital. In extrapolating from our sample to the full population, we will have to consider differences between FIM and MEDPAR populations both in hospital type and size.

Table 2.11

Comparison of FIM and MEDPAR Rehabilitation Hospitals, by Size and Type of Hospital

Hospital Size:	1996				1997			
	Number of Free-standing Hospitals		Number of Exempt Hospital Units		Number of Free-standing Hospitals		Number of Exempt Hospital Units	
Number of MEDPAR Patients	FIM	Other MED-PAR	FIM	Other MED-PAR	FIM	Other MED-PAR	FIM	Other MED-PAR
1-100	2	23	30	97	4	24	33	105
101-200	14	9	139	140	14	7	143	126
201-300	14	2	105	102	11	5	123	103
301-400	14	10	59	48	17	9	65	40
401-500	8	8	38	27	12	7	52	29
501-1000	56	16	58	26	59	15	67	18
1001-2000	20	6	6	2	24	3	6	1
2001-3000	1	0	0	0	0	0	0	0
3001-4000	1	0	0	0	1	0	0	0
Total Hospitals	130	74	435	442	142	70	489	422

The Figure 2.1 map shows that the FIM hospitals account for a substantial portion of the Medicare rehabilitation cases in almost all states. Only Nevada is not represented. There are some FIM facilities in each region, although the Midwest and southwest states appear to be slightly underrepresented.

Representativeness of Patient and Stay Characteristics

Table 2.12 compares demographic characteristics of all Medicare rehabilitation patients with the matched FIM sample. In all the characteristics examined, the FIM sample of discharges appears very similar to the full population. Although differences are quite small, FIM patients are more likely to be white and less likely to die in the hospital than other rehabilitation patients.

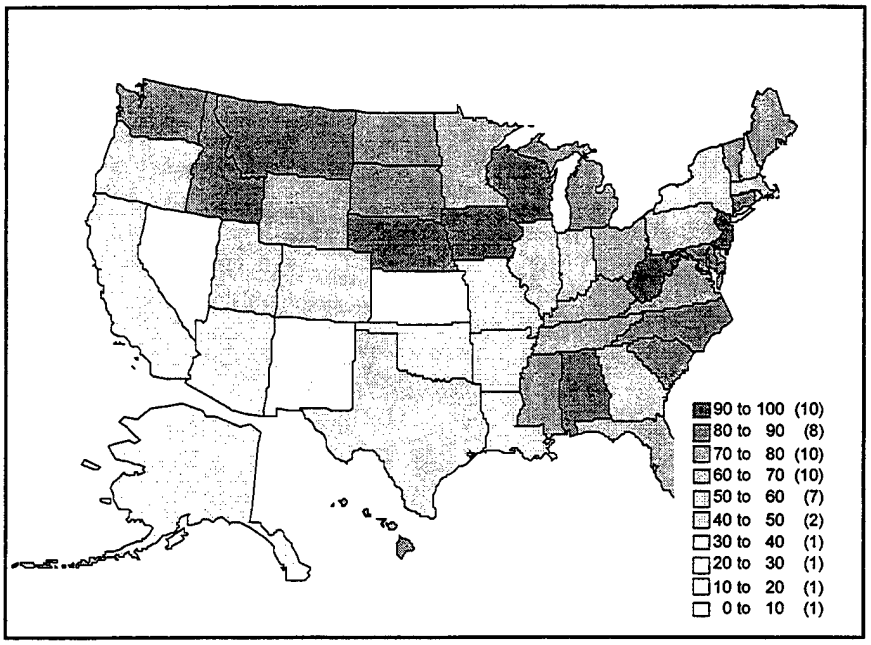

Figure 2.1—Percentage of MEDPAR Rehabilitation Cases in FIM Hospitals, by State: 1997

Table 2.12

Patient Characteristics for MEDPAR Rehabilitation Inpatients, by FIM Status

	1996			1997		
Patient Attributes	FIM Cases	Other MEDPAR Cases	All MEDPAR Cases	FIM Cases	Other MEDPAR Cases	All MEDPAR Cases
Average Age	75.4	75.6	75.5	75.4	75.6	75.5
Age 0-50 (%)	2.6	2.8	2.7	2.8	3.0	2.8
Age 51-60 (%)	3.1	3.1	3.1	3.2	3.2	3.2
Age 61-70 (%)	20.1	19.3	19.7	19.5	18.9	19.2
Age 71-80 (%)	44.2	42.8	43.5	43.9	42.8	43.4
Age 81-90 (%)	26.9	28.1	27.5	27.4	28.2	27.7
Age 91+ (%)	3.2	3.9	3.5	3.2	4.0	3.6
Male (%)	37.9	37.3	37.6	38.0	37.6	37.8
White (%)	86.7	85.8	86.3	86.6	85.3	86.1
Black (%)	9.8	10.6	10.2	10.1	10.9	10.4
Hosp death (%)	0.2	0.6	0.4	0.3	0.7	0.4
Total Rehabilitation Patients	171,626	172,500	344,126	206,032	153,000	359,032

Note: FIM case totals count matched cases, hence differ from Table 2.10, which counts matched + unmatched.

Table 2.13 compares resources used for linked FIM stays with those for other Medicare rehabilitation patients. Average length of stay for FIM cases is the same as for non-FIM

patients, but for MEDPAR cases in free-standing hospitals, FIM stays consume fewer resources: LOS and total charges are about 10 percent less. It may be necessary to do some re-weighting of FIM cases in free-standing hospitals to correct for this differential use of resources.

Table 2.13

Comparison of Resource Use for Medicare Rehabilitation Inpatients, by FIM Status

Hospitalization Characteristic	1996 FIM Cases	1996 Other MEDPAR Cases	1996 All MEDPAR Cases	1997 FIM Cases	1997 Other MEDPAR Cases	1997 All MEDPAR Cases
All Hospitals:						
Length of Stay (days)	16.2	16.2	16.2	15.7	15.7	15.7
Total charges ($)	18,013	18,790	18,403	18,348	19,287	18,748
Total therapy charges ($)	5,960	5,829	5,894	6,064	5,924	6,004
Daily therapy charges ($)	360	351	355	379	368	374
Total Rehabilitation Cases	171,626	172,500	344,126	206,032	153,000	359,032
Free-Standing Hospitals:						
Length of Stay (days)	18.0	18.9	18.4	17.8	19.2	18.2
Total charges ($)	19,443	21,214	20,207	20,202	22,541	20,915
Total therapy charges ($)	6,652	7,605	7,063	7,002	8,064	7,325
Daily therapy charges ($)	360	387	371	384	406	391
Total Rehabilitation Cases	65,349	49,584	114,933	82,393	36,148	118,541

Note: FIM case totals count matched cases, hence differ from Table 2.10, which counts matched + unmatched.

APPENDIX

The theory underlying the matching algorithm is given in Jaro (1995). The method considers each possible pairing of records (within a given rehabilitation facility) and computes the log odds of a match conditional on the values found on each file for each of the six linkage variables. It then selects the pairs with the greatest likelihood of being correct matches. A cutoff such that scores below the cutoff are not accepted as probable matches is chosen empirically.

The log odds of a match is computed as the sum of the marginal contributions of information for each of the six linkage variables (thus assuming independence across errors in the linkage variables). Three of the linkage variables (sex, race, and zip code) were treated dichotomously as either the same on both files or different. If one of these variables agreed on both files, the contribution of that variable to the log odds of a match for a particular combination of one record from each file is an estimate of the logarithm of

$$\frac{\Pr(\text{the pair of records is a match} \mid \text{agreement})}{\Pr(\text{pair does not match} \mid \text{agreement})}$$

Similarly, if a variable differed between the files, the contribution of that variable to the log odds is an estimate of the logarithm of

$$\frac{\Pr(\text{the pair of records is a match} \mid \text{disagreement})}{\Pr(\text{pair does not match} \mid \text{disagreement})}$$

In the case of a continuous variable, the marginal contribution to the linkage is based on the absolute value of the difference in the value of the variables on the two files:

$$\frac{\Pr(\text{the pair of records is a match} \mid \text{difference})}{\Pr(\text{pair does not match} \mid \text{difference})}$$

The first step in calculating these odds ratios was to take pairs thought to be sure matches and calculate the marginal error rates for each variable. This reveals the inconsistency of each variable between the two files. To determine these rates, for each linkage variable we successively matched all records in the two files on the remaining five variables and tabulated differences for the one held-out variable. For example, we would calculate the error rate in sex as the proportion of perfect matches on zip code, age, admission date, discharge date, and race, where the sex variable differed between the two files.

These error rates give us an estimate of the probability of finding disagreement given a correct match (and therefore also the complementary probability of finding agreement given a correct match). The probability of disagreement (and agreement) given no match were calculated based on randomly paired records from each file. We assumed that all these randomly paired records were non-matches.

The last step was to compute the contribution to the log odds given agreement or difference. Assuming a prior probability of match that does not vary among candidate pairs, Bayes' theorem was applied to calculate the probabilities in the odds ratios that provide the marginal contribution of each variable. Dealing with continuous variables posed additional problems because of the prior expectation that the distribution of log odds ratios would be somewhat smooth; in these cases, we smoothed the log odds using running averages of length 5, and if there was no data for a particular difference value V, we assigned it the score for V-1.

Tables 2.14 and 2.15 show the contributions to cumulative scores posed by each of the six variables used in matching. The contributions are in base 10 logarithms, and they only apply when both variables are non-missing; otherwise, the contribution is zero. For continuous variables (age, admission date, discharge date), the difference is computed and bounded at 56; every difference larger than 56 receives the match score corresponding to a difference of 56.

Table 2.14
Marginal Contribution of Dichotomous Variables to Match Score

	1996						1997					
	MOS			UDSmr			MOS			UDSmr		
Agreement	Sex	Race	Zip	Sex	Race	Zip	Sex	Race	Zip	Sex	Race	Zip
Same	0.3	0.1	1.3	0.3	0.1	1.2	0.3	0.1	1.3	0.3	0.1	1.2
Different	-1.8	-0.6	-0.9	-1.5	-0.6	-0.8	-1.7	-0.7	-0.8	-1.5	-0.6	-0.7

After summing the marginal contribution of each of the six variables for each possible pairing, we sorted the pairings. We selected the highest scoring pair as a good match and then eliminated all other pairs containing either of the matched records in this pair. We continually repeated this process, selecting the highest scoring of the remaining feasible records and eliminating all pairs containing a matched record. We stopped including matches when the match score was below 2.0. This is a very conservative criterion, and indicates that any pairs that we accepted are likely to be correct, in the sense that agreement between the two records from each file is so strong that it is not likely to result from chance.

Table 2.15
Marginal Contribution of Continuous Variables to Match Score

	1996						1997					
	MOS			UDSmr			MOS			UDSmr		
Difference	Age	Adm -Date	Dis- Date	Age	Adm -Date	Dis- Date	Age	Adm -Date	Dis- Date	Age	Adm -Date	Dis- Date
0	1.1	1.7	1.7	1.2	1.7	1.7	1.2	1.8	1.8	1.2	1.7	1.7
1	0.4	0.0	-0.1	0.5	0.2	0.3	0.4	-0.1	0.0	0.5	0.1	0.3
2	-0.3	-0.6	-0.6	-0.2	-0.3	-0.2	-0.3	-0.6	-0.5	-0.2	-0.4	-0.2
3	-0.8	-1.2	-1.2	-0.7	-0.9	-0.8	-0.9	-1.2	-1.2	-0.7	-1.0	-0.8
4	-1.3	-1.4	-1.4	-1.2	-1.1	-1.0	-1.4	-1.2	-1.4	-1.2	-1.2	-1.1
5	-1.5	-1.4	-1.5	-1.3	-1.2	-1.2	-1.5	-1.3	-1.4	-1.3	-1.3	-1.3
6	-1.6	-1.6	-1.5	-1.4	-1.3	-1.3	-1.6	-1.3	-1.5	-1.4	-1.4	-1.4
7	-1.6	-1.4	-1.4	-1.4	-1.4	-1.4	-1,6	-1.2	-1.5	-1.5	-1.4	-1.5
8	-1.6	-1.3	-1.4	-1.5	-1.3	-1.4	-1.6	-1.2	-1.5	-1.5	-1.5	-1.4
9	-1.6	-1.4	-1.5	-1.5	-1.4	-1.4	-1.6	-1.2	-1.4	-1.5	-1.6	-1.4
10	-1.6	-1.4	-1.4	-1.5	-1.4	-1.5	-1.6	-1.2	-1.4	-1.6	-1.6	-1.4

Table 2.15 (cont'd)
Marginal Contribution of Continuous Variables to Match Score

	1996						1997					
	MOS			UDSmr			MOS			UDSmr		
Difference	Age	Adm -Date	Dis- Date	Age	Adm -Date	Dis- Date	Age	Adm -Date	Dis- Date	Age	Adm -Date	Dis- Date
11	-1.6	-1.5	-1.5	-1.5	-1.4	-1.5	-1.7	-1.2	-1.4	-1.6	-1.6	-1.5
12	-1.6	-1.5	-1.7	-1.6	-1.5	-1.6	-1.8	-1.2	-1.4	-1.7	-1.7	-1.6
13	-1.7	-1.7	-1.7	-1.7	-1.6	-1.7	-1.8	-1.3	-1.4	-1.7	-1.8	-1.7
14	-1.8	-1.6	-1.7	-1.7	-1.7	-1.7	-1.9	-1.4	-1.5	-1.8	-1.8	-1.8
15	-1.8	-1.6	-1.7	-1.8	-1.7	-1.7	-1.9	-1.4	-1.5	-1.8	-1.8	-1.9
16	-1.8	-1.7	-1.8	-1.8	-1.8	-1.7	-1.8	-1.5	-1.4	-1.9	-1.9	-1.8
17	-1.8	-1.7	-1.6	-1.8	-1.8	-1.7	-1.8	-1.5	-1.4	-1.9	-1.8	-1.8
18	-1.8	-1.6	-1.7	-1.8	-1.9	-1.8	-1.8	-1.5	-1.4	-1.9	-1.9	-1.8
19	-1.7	-1.8	-1.7	-1.8	-1.9	-1.8	-1.8	-1.5	-1.4	-1.8	-2.0	-1.9
20	-1.8	-1.9	-1.7	-1.9	-2.0	-1.9	-1.8	-1.5	-1.4	-1.9	-2.0	-2.0
21	-1.9	-1.9	-1.7	-1.9	-2.0	-2.0	-1.9	-1.5	-1.5	-2.0	-2.1	-2.0
22	-2.1	-2.0	-1.9	-2.0	-2.0	-2.1	-2.1	-1.7	-1.4	-2.0	-2.2	-2.1
23	-2.1	-2.1	-1.8	-2.1	-2.1	-2.1	-2.1	-1.7	-1.5	-2.2	-2.1	-2.2
24	-2.2	-2.1	-1.8	-2.2	-2.2	-2.1	-2.2	-1.9	-1.5	-2.2	-2.2	-2.2
25	-2.3	-2.1	-1.9	-2.4	-2.2	-2.1	-2.3	-1.9	-1.4	-2.2	-2.3	-2.2
26	-2.4	-2.0	-2.0	-2.4	-2.2	-2.1	-2.3	-1.9	-1.6	-2.2	-2.3	-2.3
27	-2.3	-2.1	-2.0	-2.4	-2.3	-2.2	-2.1	-1.9	-1.6	-2.3	-2.4	-2.3
28	-2.3	-2.1	-2.1	-2.3	-2.3	-2.2	-2.1	-1.8	-1.7	-2.2	-2.4	-2.2
29	-2.3	-2.2	-2.2	-2.3	-2.3	-2.2	-2.2	-1.7	-1.7	-2.2	-2.4	-2.2
30	-2.2	-2.2	-2.2	-2.1	-2.4	-2.2	-2.1	-1.7	-1.8	-2.4	-2.6	-2.3
31	-2.2	-2.3	-2.2	-2.2	-2.3	-2.3	-2.2	-1.8	-1.7	-2.5	-2.6	-2.3
32	-2.1	-2.3	-2.1	-2.3	-2.4	-2.4	-2.2	-1.9	-1.8	-2.6	-2.7	-2.3
33	-2.1	-2.3	-2.1	-2.4	-2.6	-2.4	-2.2	-2.0	-1.8	-2.7	-2.7	-2.5
34	-2.0	-2.3	-2.1	-2.4	-2.6	-2.5	-2.2	-2.0	-1.8	-2.7	-2.7	-2.7
35	-2.0	-2.3	-2.1	-2.4	-2.6	-2.5	-2.2	-2.0	-1.9	-2.5	-2.7	-2.6
36	-2.0	-2.3	-2.2	-2.5	-2.7	-2.6	-2.2	-2.1	-1.9	-2.4	-2.8	-2.7
37	-2.0	-2.3	-2.2	-2.3	-2.8	-2.5	-2.2	-2.1	-2.0	-2.3	-2.8	-2.7
38	-2.0	-2.3	-2.2	-2.2	-2.8	-2.5	-2.0	-2.1	-2.1	-2.3	2.9	-2.7
39	-2.0	-2.3	-2.2	-2.3	-2.9	-2.5	-2.0	-2.1	-2.2	-2.2	-2.9	-2.7
40	-2.0	-2.3	-2.2	-2.3	-3.0	-2.6	-2.0	-2.1	-2.2	-2.3	-2.9	-2.9
41	-2.0	-2.3	-2.2	-2.3	-3.0	-2.8	-2.0	-2.2	-2.2	-2.3	-2.9	-2.9
42	-1.9	-2.3	-2.2	-2.3	-3.0	-2.8	-2.0	-2.2	-2.2	-2.3	-2.9	-3.0
43	-1.8	-2.3	-2.2	-2.4	-2.9	-2.7	-1.8	-2.2	-2.1	-2.4	-2.9	-3.0
44	-1.7	-2.3	-2.2	-2.3	-2.9	-2.7	-1.8	-2.3	-2.1	-2.4	-2.9	-2.9
45	-1.7	-2.3	-2.2	-2.3	-2.9	-2.6	-1.8	-2.3	-2.1	-2.4	-2.9	-2.9
46	-1.7	-2.3	-2.2	-2.2	-2.9	-2.6	-1.8	-2.4	-2.2	-2.4	-3.0	-2.8
47	-1.7	-2.3	-2.2	-2.1	-2.9	-2.6	-1.8	-2.4	-2.3	-2.4	-2.9	-2.9
48	-1.7	-2.3	-2.2	-2.0	-2.9	-2.6	-1.8	-2.4	-2.3	-2.2	-2.9	-2.9
49	-1.7	-2.3	-2.2	-2.0	-2.9	-2.7	-1.8	-2.3	-2.4	-2.1	-3.0	-2.9
50	-1.7	-2.3	-2.1	-2.1	-2.9	-2.7	-1.7	-2.3	-2.4	-2.1	-3.0	-2.9
51	-1.7	-2.3	-2.1	-2.1	-2.9	-2.8	-1.7	-2.3	-2.4	-2.1	-3.0	-2.9
52	-1.7	-2.3	-2.1	-2.2	-3.0	-2.8	-1.7	-2.3	-2.4	-2.1	-3.0	-2.9
53	-1.7	-2.3	-2.1	-2.3	-3.0	-2.8	-1.7	-2.3	-2.4	-2.0	-3.0	-2.9
54	-1.7	-2.3	-2.1	-2.3	-3.0	-2.8	-1.7	-2.3	-2.3	-2.2	-3.0	-2.9
55	-1.7	-2.3	-2.1	-2.3	-3.0	-2.8	-1.7	-2.3	-2.3	-2.1	-3.0	-2.9
56	-1.7	-2.3	-2.1	-2.4	-3.0	-2.8	-1.7	-2.3	-2.3	-2.1	-3.0	-2.9

3. ADDITIONAL DATA AND VARIABLE DEFINITIONS

In this section we will describe the data that we will use for the analysis, in addition to the linked MEDPAR-FIM data discussed in the previous section. Here, we also describe three of the variables that are to be used in multiple places throughout our analyses: Function Related Groups or FRGs, the cost of a discharge, and transfer cases.

DATA

In addition to the merged file containing FIM and MEDPAR information, we will assemble a provider level file containing information on all rehabilitation facilities, additional utilization information, and MDS-PAC data.

Provider File

We will begin with a list of all currently certified rehabilitation facilities from the OSCAR file. To the extent possible, we will link providers on our merged MEDPAR-FIM file to their current provider numbers.

For each rehabilitation facility we will assemble information from HCRIS files and other sources including: (1) the wage indices in the area containing the hospital that are used for hospital payment (i.e., after reclassification) and for the SNF PPS (i.e., before reclassification), (2) data on the number of residents assigned to excluded units and the distribution of resident time across inpatient/outpatient settings, (3) data on the fraction of Medicare cases at each rehabilitation facility that are SSI recipients (person level data are not needed), and (4) information about TEFRA payments.

HCFA will provide us with the expected TEFRA payment rate at each rehabilitation facility in the hospital's fiscal year(s) that will occur during the FY 2001. To the extent possible, these rates will reflect: (1) expected inflation in costs from the latest available cost report, (2) all BBA limitations on the target amounts, and (3) corrected target rates for hospitals that rebased in their fiscal year that began in FY 1998 from HCFA's files.

Utilization Data

We will summarize Medicare bills for each beneficiary who was hospitalized in a rehabilitation facility during 1996 and 1997. From the MEDPAR we will select the acute care episode that preceded the rehabilitation hospitalization. These will be used to examine the coding of RIC on our matched MEDPAR-FIM file, and, possibly to infer case mix for facilities

not appearing on that file (see Section 8). We will also find the hospitalization, if any, that immediately followed discharge from the rehabilitation facility. We will also summarize SNF bills, if any, for services provided soon after discharge from the rehabilitation facility. The bills and hospitalizations will be used to analyze transfer cases (see below and Section 6).

We will also obtain and analyze the beneficiaries use of HHAs, outpatient departments of hospitals, and Part B services. The entire set of utilization records will be used in the design of the monitoring system as discussed further in Section 10.

MDS-PAC Data

As information becomes available for other HCFA projects (i.e., the MDS-PAC pilot project and the ASPEN contract for staff time measurement studies[1]), we will incorporate these into our analyses. In particular, we need an estimate of the reliability of FRG assignment. In addition, we need to study the reliability of individual items on the MDS-PAC that relate to FIM items and the impact of these reliabilities on the FIM motor and FIM cognitive scores (see Section 9 below).

DERIVED VARIABLES

Function Related Groups with Comorbidities

The amount that each case at a hospital will be paid in the fully phased-in RPPS will be determined in large part by the FRG to which it is assigned and its comorbidity status. The first partition in creating FRGs is the Rehabilitation Impairment Category or RIC, a grouping of codes for the primary cause of the rehabilitation hospitalization. The RICs were created based on clinical criteria and, except for a small miscellaneous group, do not group patients who are clinically different from one another in the same RIC.

Each RIC is subdivided based on age and functional status. Functional status is measured by the Functional Independence Measure or FIM. The FIM is an 18-item measure covering six domains: self-care (six activities of daily living), sphincter control (two items on bowel and bladder management), mobility (three transfer items), locomotion (two items on walking/wheelchair use and stairs), communication (two items on comprehension and expression), and social cognition (three items on social interaction, problem solving, and memory). The first four domains—self-care, sphincter control, mobility, and locomotion—are combined into a single motor scale. Similarly, the last two domains—communication and social cognition—are combined to form a single cognitive scale. All 18 items are scored into one of

seven levels of function ranging from complete dependence (1) to complete independence (7) and the motor scale and the cognitive scale are created as the sum of the relevant responses—so the motor scale is in the interval from 13 to 91 and the cognitive scale is in the interval from 5 to 35.

The FRGs were originally developed by Dr. Margaret Stineman and colleagues (Stineman et al., 1994) and updated in Stineman et al., 1997. The FRGs were evaluated and updated using 1994 data as part of the effort to build a model RPPS (Carter, Relles, et al., 1997). In the RAND analysis, comorbidities were found to predict resource use in most RICs and their classification system was then called FRGCs for FRG with comorbidity. In that system, the presence of at least one major comorbidity would multiply the payment for the case by an amount that depended on RIC.

Table 3.1

Grouping of Impairment Group Codes into Rehabilitation Impairment Categories

Rehabilitation Impairment Category	Impairment Groups
1 Stroke	1.1 through 1.9
2 Traumatic brain injury	2.2, 2.21, 2.22
3 Nontraumatic brain injury	2.1, 2.9
4 Traumatic spinal cord	4.2, 4.21 through 4.23
5 Nontraumatic spinal cord	4.1, 4.11 through 4.13
6 Neurological	3.1, 3.2, 3.3, 3.5, 3.8, 3.9
7 Hip fracture	8.11 through 8.4
8 Replacement of LE joint	8.51 through 8.72
9 Other orthopedic	8.9
10 Amputation, lower extremity	5.3 through 5.7
11 Amputation, other	5.1, 5.2, 5.9
12 Osteoarthritis	6.2
13 Rheumatoid, other arthritis	6.1, 6.9
14 Cardiac	9
15 Pulmonary	10.1, 10.9
16 Pain Syndrome	7.1 through 7.9
17 Major multiple trauma, no brain injury or spinal cord injury	14.9
18 Miscellaneous	11, 12.1, 12.9, 13, 15, 16, 17 through 17.9
19 Guillian Barre	3.4
20 Major multiple trauma, with brain injury or spinal cord injury	14.1, 14.2, 14.3

As will be described in more detail in Section 4, one of the major tasks of our project is to update the FRGC system. However, we will also evaluate the existing FRGC classification system and even use it for preliminary analysis of other payment elements. Therefore we present the FRG portion of this classification system in Tables 3.1 and 3.2. Table 3.1 shows the preliminary correspondence between the impairment codes on the FIM and the RIC. The

[1] Contract number 5005-97-434, Task Order #2004.

impairment codes for medically complex cases, codes 17.x, were first used in the UDSmr database in July 1997. The limited duration of use of these codes in our database will limit our ability to analyze the resources used by cases with these codes.

Table 3.2 shows the definition of our preliminary FRGs. These are the FRGs that were defined in Carter, Relles, 1997 based on MEDPAR cost. The comorbidity indicator used in the FRGC is 1 if the patient has any one of the diagnoses listed as a 'major comorbidity' in the refined DRGs (DHHS, 1993) and 0 otherwise.[2] In the interest of completeness these codes are listed in the Appendix.

Cost Per Case

We will use the departmental method to estimate the accounting cost of MEDPAR discharges. This method combines MEDPAR information about charges in each ancillary department with the departmental cost-to-charge ratio (CCR) to estimate costs incurred by the patient in the department (see, for example, Newhouse et al., 1989). Separate per diems for routine and special care days are combined with MEDPAR counts of such days to estimate routine and nursing costs. Special care days are days spent in intensive care units or in coronary care units. Fewer than 1 percent of rehabilitation days are spent in such units.

The CCRs and per diems will be calculated from the PPS 12, 13 and 14 cost reports. The cost report that includes the date of the discharge will be chosen for each case. In preliminary analysis the PPS 13 cost report will be used for discharges in PPS 14, with the per diems inflated based on the observed rate of increase in hospital per diems between PPS 12 and PPS 13. Hospitals that are all-inclusive providers[3] are omitted from analyses of case level cost and their data will not be used in calculating weights or parameters for payment of transfer cases.[4] Such hospitals are of course included in the PPS. Some departmental CCRs are missing or were found to be outside a plausible range[5]. In these cases, we used the mean value of the CCR for the department within the set of either free-standing hospitals or of units within acute-care hospitals. Routine care per diem rates were always available and appeared plausible. Special care per diem rates are used relatively rarely for rehabilitation patients, but appeared reasonable for hospitals that have special care days.

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[2] These codes have been updated to account for changes in the ICD-9-CM coding system as will be discussed in section 4.

[3] In the PPS13 file only 21 rehabilitation facilities (2 percent) are listed as all inclusive providers.

[4] Since average cost per case is available at the facility level, it should be possible to include data from these hospitals in the facility level adjustment analyses, the simulations, and the impact analyses.

[5] In many, but not all, cases where the CCR is missing, we find no charges for that department on the MEDPAR.

Table 3.2
Definition of Preliminary FRGs

RIC	Group	Range for motor score (amot), cognitive score (acog), and age
1	1	amot<49.5 * amot<39.5 * age<84.5
1	2	amot<49.5 * amot<39.5 * age>84.5
1	3	amot<49.5 * amot>39.5
1	4	amot>49.5 * amot<62.5
1	5	amot>49.5 * amot>62.5
2	1	amot<32.5
2	2	amot>32.5 * amot<52.5
2	3	amot>32.5 * amot>52.5
3	1	amot<43.5 * amot<26.5
3	2	amot<43.5 * amot>26.5
3	3	amot>43.5 * amot<56.5
3	4	amot>43.5 * amot>56.5
4	1	amot<14.5
4	2	amot>14.5 * amot<35.5 * age<57.5
4	3	amot>14.5 * amot<35.5 * age>57.5
4	4	amot>14.5 * amot>35.5
5	1	amot<46.5 * amot<36.5 * amot<21.5
5	2	amot<46.5 * amot<36.5 * amot>21.5
5	3	amot<46.5 * amot>36.5
5	4	amot>46.5 * amot<55.5
5	5	amot>46.5 * amot>55.5
6	1	amot<50.5 * amot<41.5
6	2	amot<50.5 * amot>41.5 * age<88.5
6	3	amot<50.5 * amot>41.5 * age>88.5
6	4	amot>50.5 * amot<58.5
6	5	amot>50.5 * amot>58.5
7	1	amot<46.5 * amot<43.5
7	2	amot<46.5 * amot>43.5
7	3	amot>46.5 * amot<55.5 * acog<32.5
7	4	amot>46.5 * amot<55.5 * acog>32.5
7	5	amot>46.5 * amot>55.5
8	1	amot<49.5 * amot<42.5
8	2	amot<49.5 * amot>42.5
8	3	amot>49.5 * amot<58.5 * acog<33.5
8	4	amot>49.5 * amot<58.5 * acog>33.5
8	5	amot>49.5 * amot>58.5
9	1	amot<52.5 * amot<40.5
9	2	amot<52.5 * amot>40.5
9	3	amot>52.5
10	1	amot<50.5
10	2	amot>50.5
11	1	amot<62.5
11	2	amot>62.5
12	1	amot<51.5
12	2	amot>51.5
13	1	amot<45.5 * amot<36.5
13	2	amot<45.5 * amot>36.5
13	3	amot>45.5 * amot<72.5

Table 3.2 (cont'd)
Definition of Preliminary FRGs

RIC	Group	Range for motor score (amot), cognitive score (acog), and age
13	4	amot>45.5 * amot>72.5
14	1	amot<57.5 * amot<44.5 * amot<33.5
14	2	amot<57.5 * amot<44.5 * amot>33.5
14	3	amot<57.5 * amot>44.5
14	4	amot>57.5 * amot<65.5
14	5	amot>57.5 * amot>65.5
15	1	amot<49.5 * amot<40.5 * age<72.5
15	2	amot<49.5 * amot<40.5 * age>72.5
15	3	amot<49.5 * amot>40.5
15	4	amot>49.5 * amot<55.5
15	5	amot>49.5 * amot>55.5
16	1	amot<57.5
16	2	amot>57.5
17	1	*** no splits ***
18	1	amot<49.5 * amot<42.5
18	2	amot<49.5 * amot>42.5
18	3	amot>49.5 * amot<57.5
18	4	amot>49.5 * amot>57.5
19	1	amot<45.5 * amot<28.5
19	2	amot<45.5 * amot>28.5
19	3	amot>45.5
20	1	*** no splits ***

Transfer Cases

There are three potential methods of determining where a patient in a rehabilitation facility went after discharge. First, the MEDPAR contains a field called discharge destination which distinguishes discharges to home, acute care hospitals, SNFs, and other destinations. Second, each of the FIM instruments provides information about the living setting to which the patient was discharged, distinguishing many of the same settings as MEDPAR and a few additional ones.[6] Third, we can use Medicare bills to determine which patients went to each of the settings that will classify the patient as a transfer: acute care, other hospital, SNF.

Previous examination of the use of the MEDPAR discharge destination to define transfers from acute care showed many errors of omission (Carter and Rumpel, 1993). In preliminary analyses, we will use transfer as defined on the FIM records. We will use the definition from Medicare bills as soon as we receive records of SNF stays for rehabilitation patients.

Options for paying for transfer cases will be discussed in Section 6.

4. CASE CLASSIFICATION

The rehabilitation prospective payment system will use discharge as the unit of payment. Rehabilitation is inherently episodic. The vast majority of rehabilitation episodes begin with an acute event. The goal of inpatient rehabilitation is functional improvement that will allow the patient to return to independent living in the community, and the majority of cases are in fact discharged to a community setting. A discharge is also the current unit of payment under TEFRA.

It is worth noting that a discharge is not the same as a case as defined in the UDSmr database. In that database, but apparently not in the MOS database, cases transferred from rehabilitation to acute care for 30 days or less are treated as a single, interrupted, rehabilitation case while current HCFA rules count each part of the interrupted case as separate rehabilitation discharges if the case is actually discharged from the rehabilitation facility (which it often is). In previous work we found that a model RPPS could be adequately built with either definition of a case. Administrative simplicity and consistency with past policy argues for using discharges.

The case classification system will be used to classify cases that are medically similar and that have similar expected resource needs. The case classification system will be based on the structure of the Function Related Groups (FRGs) enhanced with information about comorbidities.

EVALUATING THE FRG-COMORBIDITY GROUPS FROM EARLIER WORK

We will evaluate our previous case classification system to see how it performs on 1996 and 1997 data. This will either build confidence in the robustness of the FRG-Comorbidity (FRGC) system or point out areas where changes are needed in the system.

Functional Related Groupings

Multiple FRG systems exist, none of which are precisely correct for a Medicare RPPS. The original FRGs, as well as the official version 2, were based on substantially older data and are not restricted to Medicare cases. The RAND work was based on 1994 data which is older than the 1996 and 1997 data now available to us. One of the sets of FRGs in that study was created from an analysis of the cost of Medicare cases. This FRG set is closest to that which we want, so we will use it for our evaluation of the classification system that was built on 1994 data.

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[6] The setting choices on the 2 FIM instruments are similar but not identical. Nevertheless, by grouping the codes on each instrument, one can define settings that are comparable.

The evaluation will include a comparison of the percent of the variance in the log of cost explained by the FRGs with that explained in the 1994 data that created the FRGs. The comparison will be overall and within individual RIC.

Comorbidities

The comorbidity variable used in our earlier work was an indicator that the person had one or more 'Major Cormorbidities'. The major comorbidities were defined as those diagnoses that were found in a study of refined DRGs to have major effects on the costs of acute stays. We found that the presence of at least one of these diagnoses also increased the cost of rehabilitation stays in FY 1994, by a multiplicative amount that depended on RIC.

This major comorbidity list was coded using the ICD-9-CM diagnoses in use in FY 1994 (October 1, 1993). We added new codes that are now used to code patients that would have received a diagnosis on the old major comorbidity list. We examined all the newly created codes published in the federal register for Sept 1994, 95, 96, and 97. For each code that was a CC in one of the tables, we determined whether it was a further specification of a code that was a major comorbidity in the initial list and therefore would have been coded as a major comorbidity prior to the new code creation. The codes thus added to the list of major comorbidities are given in Table 4.1.

As shown in Carter, Relles et al. (1997), the presence of major comorbidities multiplies the expected resource use of a case by the same amount for each FRG in the same RIC. This relationship was found empirically to produce a good fit. For example, we tested whether comorbidities had different effects in different FRGs within the same RIC and found that they did not. We used residual plots to show that the multiplicative model fit the data (rather than, for example, an additive model). We also examined whether some comorbidities and groups of comorbidities had different level of effects and found that they did not.

In this study we will verify the accuracy of the multiplicative model applying the tests discussed above to our new data. We will also examine the magnitude and significance of the comorbidity effect in each RIC, comparing the effect found in the 1996 and 1997 data to that found in 1994. The effect is calculated from regressions, for each RIC, of the log of cost on dummy variables for each FRG and on comorbidity. (Equations are given in Section 5 below).

Differences Between Data Used in this Study and Used Earlier

The FRG-comorbidity set will be evaluated on the 1996 and 1997 merged FIM-MEDPAR data described in Section 2 above. These data differ from the data used in the creation of these FRGs in that: (1) they contain many more facilities and cases, particularly from for-profit

facilities, (2) Some facilities appearing in the 1994 data and in the later data will be omitted because they are not rehabilitation facilities, (3) Discharges will be the unit of analysis rather than UDSmr cases, and (4) Some additional impairment codes have been added thus perhaps changing the clinical mix of cases within some RICs. Thus, good performance by the FRG-comorbidity set in predicting costs in the 1996 and 1997 data would be a strong indicator that the classification system will be robust.

Table 4.1

New ICD-9-CM Codes Added to the List of Major Comorbidities

Code No.	Major Comorbidity
*	Staphyloccal septicemia, unspecified
03811	Staphyloccal aureus septicemia
03819	Other staphyloccal septicemia
07022	Chronic viral Hep B with hepatic coma, wo mention of hepatitis delta
07023	Chronic viral Hep B with hepatic coma, with hepatitis delta
07044	Chronic hepatitis C with hepatic coma
41511	Iatrogenic pulmonary embolism and infarction
41519	Other pulmonary embolism and infarction
44100	Dissecting aortic aneurysm of unspecified site
44101	Dissecting thoracic aortic aneurysm
44102	Dissecting abdominal aortic aneurysm
44103	Dissecting thoracabdominal aortic aneurysm
48284	Legionaires disease

UPDATING THE FRGS

Data Sets

We will use the 1996 and 1997 merged MEDPAR-FIM data to obtain FRG definitions that predict the cost of Medicare cases in rehabilitation facilities. In all exploratory analyses, fifty percent of the data will be used and the remaining data will be used to evaluate the models. Final calibration of the chosen model will be based on 100 percent of the calendar year 1997 data, as this is the most recent case mix data available.

The unit of analysis will be a discharge. We will eliminate atypical cases and statistical outliers from our analysis aimed at defining the FRGCs.

Rehabilitation Impairment Categories

The first partition in creating FRGs is the RIC, a grouping of codes for the primary cause of the rehabilitation hospitalization. We expect to use definitions of RIC that are very similar to those we used in our previous study (see Section 3). The larger sample size now available

should allow us to test whether subgroups of the miscellaneous RIC (18) have different costs. The technical advisory panel for RAND's earlier study had wished to separate burns, debility, and developmental disabilities, but this was not possible with the limited sample available then. Further, the new codes for cases whose cause for rehabilitation relates to medically complex conditions may provide further opportunity for refining the definition of the RICs.

Groupings

We will use the CART algorithm to create groups within each RIC. The CART algorithm examines a set of input independent variables and searches for a series of binary partitions that maximizes the percentage of variance in the dependent variable that is explained (R-square). At each iteration, CART searches for the two-way split of any existing group that maximizes R-square. The log of the cost of the case will be the dependent variable for our classification. Functional independence will be measured by the FIM motor score and the FIM cognitive score. Age will first be entered as a continuous variable. If many RICs split on age, we will evaluate whether age splits should be restricted to enforce consistency in the definition.

We will use the 10-fold cross-validation method, or a similar method, to determine the optimal number of splits in the final classification tree. CART's method is to divide the data into ten mutually exclusive sets of equal size, chosen at random. For each set, a tree with k nodes is fit on the other 90 percent of the data, and the squared error of the predictions is computed and summed over sets. CART then chooses the k with the minimum sum of squared error, and it fits a tree on the entire dataset with k nodes. This method will result in many splits in large RICs.

We will examine the improvement in predictive power and the differences across FRGs in mean cost as the number of FRGs increases.

UPDATING AND REFINING THE DEFINITION OF COMORBIDITY

In our work with 1994 data, we examined whether some comorbidities and groups of comorbidities had different level of effects and found that they did not. However, because our data set is larger now, we will be able to measure the effects of individual comorbidities more precisely. Thus we intend to examine whether there may be some comorbidities that have substantially different effects on total costs than other major comorbidities. We will also re-evaluate the groups of comorbidities originally identified by the physicians on our earlier project[7] to see if the larger sample size allow us to measure their effect. We will also examine the relationship of frequently occurring comorbidities to individual impairment codes and RICs

in order to ensure that all the chosen comorbidities are in fact relevant to that RIC. For example, some pulmonary diagnoses might be judged to be not a relevant comorbidity for patients in the Pulmonary RIC or for patients with COPD.

One difficulty with detecting and measuring the effect of comorbidities on total costs has to do with the many variables that are not adequately controlled in our data set such as level of impairment and a variety of psychological and social factors. It is possible that we could more easily measure and detect the effect of particular comorbidities on particular non-therapy ancillary expenses. If large non-therapy ancillary costs are concentrated in a small number of identifiable patients within the set of patients with major comorbidities, then we could improve the accuracy of our payment system by exploring options. For example patients with ESRD might be paid for dialysis expenditures.

We will use clinical judgment to develop hypotheses about the relationship between subgroups of the major comorbidities and types of unusual expenses such as drugs, expensive prostheses, and specific expensive diagnostic tests. We will then use the MEDPAR data to examine the distribution of costs within these comorbidity groups within MEDPAR departmental categories, while controlling for FRG. In carrying out these analyses, we will insure that observed costs are not substitutes for costs not listed in other MEDPAR departments. If large specific effects are found, it would argue for differential payments for these patients.

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[7] See Appendix B of Carter, Relles, et. al. (1997).

5. RELATIVE WEIGHTS

For any particular hospital, the payment for each case will be proportional to the relative weight assigned to the patient's FRGC. To ensure that beneficiaries in all FRGCs will have access to care and to encourage efficiency, we will calculate weights that are proportional to the resources needed by a typical case in the FRGC. So, for example, cases in an FRGC with weight of 2 will cost twice as much as cases in an FRGC with a weight of 1.

The average of the relative weights for a set of cases is called the case mix index or CMI. The CMIs for cases at different hospitals can be compared to describe the relative costliness of each hospital's case mix.

There are a variety of ways in which relative weights could be calculated. In the following section, we review several of these methods and explain why we have chosen to use cost based weights using the hospital specific relative value (HSRV) method. Then we present details of the selected algorithm.

TYPES OF WEIGHTS

In previous work, we examined alternatives that differed in the measure of resource use (charge vs. cost), the method used to control for variations in costs across facilities (hospital specific standardization vs. payment factors) and whether the weight algorithm should account for the proportion of outlier payments in the payment group. We found only modest differences among the various types of weights with respect to (1) their ability to explain costs at the case level, (2) their ability to explain costs at the hospital level, (3)associated hospital payment factors, and (4) payment to cost ratios for groups of hospitals (Carter, Buchanan, et al., 1997). Consequently, we can decide among the methods based on theoretical grounds.

Resource Measure

Cost-based weights were used in the initial acute care PPS implementation, but charge-based weights have been used since FY 1986. Cotterill et al. (1986) found charge- and cost-based weights for the acute care PPS to be quite similar. Similarly, we found cost and charge weights to be quite similar in our model of a rehabilitation RPPS.

One of our major analytic goals is to determine whether cases with comorbidities require additional resources. The distribution of patients with these comorbidities may vary substantially across rehabilitation facilities. Thus our criteria of access and provider fairness require that we measure additional costs associated with comorbidities accurately.

In earlier work, we found that comorbidities had a measurable effect on cost per day, and we expect that is because of the additional non-therapy ancillary services required by these patients. As shown in Table 5.1, the cost-to-charge ratios of several of the major ancillary departments, namely laboratory, pharmacy, supplies, and respiratory therapy are substantially lower than those of the major therapy departments. Thus using charges would overestimate the costs of cases that use more than average of these services. On the other hand the cost-to-charge ratio of the dialysis department is unusually high so that charge based weights would underestimate the cost of cases needing dialysis.

Charge-based weights can be updated more quickly than cost-based weights because they do not require the filing and auditing of cost reports, a process that may take up to two years. Charge-based weights can be updated based on discharge data that are typically available after only six months.

These options will be explored and recommendation made to HCFA about the method for measuring resource use in calculating FRGC weights.

Table 5.1

Mean Cost to Charge Ratios for Ancillary Departments in Rehabilitation Facilities

Department	Number of Facilities	Cost to Charge Ratio
Laboratory	986	0.39
Pharmacy	990	0.35
Respiratory therapy	955	0.33
Supplies	967	0.43
Radiology	990	0.48
Physical Therapy	974	0.61
Occupational Therapy	656	0.57
Speech Therapy	641	0.63
Dialysis	452	0.76
Blood products and administration	506	0.75
Other	960	0.81

Note: Based on PPS 13 cost reports for hospitals reporting good data. The department 'other' excludes surgery and anaesthesiology departments which are rarely used by rehabilitation inpatients.

Note 2: Rehabilitation providers identified from provider number and presence of exempt unit of type T.

Controlling for Hospital Costs

Both charges and costs are affected by hospital characteristics for which the RPPS would adjust payment—i.e., the factors that go into the calculation of the facility payment factor. In

the standard method used to calculate DRG weights, charges are first standardized by the hospital's payment factor.

The payment factors capture only a small part of the variation across hospitals in costs for any specific DRG. A method that accounts for more of the cross-hospital variation in costs than the standard method is the hospital specific relative value (HSRV) method. The HSRV method differs from the standard method in that a hospital's costs are not standardized using its payment factor, but instead are standardized using hospital-specific costs and the hospital's case mix index. The HSRV method should be superior to the standard method because it produces weights that reflect relative accounting costs. However, because within department pricing rules vary and are unknown, there is no guarantee that, after averaging across hospitals, the HSRV method will yield relative weights closer to relative actual costs (rather than accounting costs).

In our earlier study, we evaluated both methods of controlling for hospital costs. Using the standard method and the facility payment factor to standardize charges provides similarity to the acute care PPS. However, Hosek et al. (1986) found substantial correlation in charges and length of stay for patients treated at the same facility even after controlling for impairment group, functional status, and facility characteristics. Further, the TEFRA rules have allowed newly certified units to recover larger costs. These earlier findings will be reassessed and analyzed using updated information.

Fair Weights

The term 'fair weights' has been given to the result of weight calculations that adjust for outlier case costs because these cases receive additional reimbursement. Under the acute care PPS, DRG weights are calculated to be proportional to the resources used by the average case in the DRG. Fair weights could be calculated so that, instead, total PPS standardized reimbursement (including outlier payment) would be proportional to the resources used by the average case in the DRG. Such fair weights have been considered by ProPAC (1994).

Outlier payments will be a higher percentage of RPPS payments in some FRGs than in others. This is appropriate insofar as it provides more outlier payment for the cases that would otherwise cause the highest losses. Adjusting for the amount of outlier payment will be analyzed using more recent HCFA administrative data.

ALGORITHM

The first step in the calculation of FRGC weights is to estimate the effect of comorbidities. The second step is to adjust the costs of each discharge for these effects. These

adjusted resource use values for each discharge are then used to calculate "relative adjusted weights" in each FRG. The final steps are to calculate the weight by modifying the "relative adjusted weight" with the effects of comorbidity and normalize the weights to 1.

Estimating the Effect of Comorbidity

As shown in Carter, Relles et al. (1997), the presence of major comorbidities multiplies the expected resource use of a case by the same amount for each FRG in the same RIC. As discussed in Section 4 above, in this study we will verify the accuracy of the multiplicative model. For simplicity, we will write the rest of this sub-section assuming that the multiplicative model is correct. Appropriate modifications will be made if other models are found more appropriate.

We use regression to calculate the comorbidity weight for a MEDPAR discharge. The weight for a MEDPAR discharge in FRG k is given by

$$W(k,x) = \exp(ax)*w_k, \qquad (2)$$

where x is a vector of variables describing the patients comorbidities. In the simplest case (which we used in the 1997 study):

x = 1 if the patient had one or more comorbidities,
= 0 otherwise, and

Separate regressions will be used for each RIC. Payment effects will be recommended only if coefficients are positive, significant, and of large enough size to be important. For example, in our previous work, there was no measurable positive effect of comorbidity on stroke patients. For each RIC, we will report the R-square, coefficient and the t-statistic.

Adjustment for Comorbidity

The second step in the calculation of weights is to adjust the resource use for each case to eliminate the effect of comorbidities. Under the multiplicative model, the adjusted resource use for a discharge, with values x for comorbidity is:

$$A = \text{case\_cost}/\exp(ax).$$

These adjusted resource use values for each discharge are then used to calculate the relative adjusted weight in each FRG k, w_k.

HSRV Method for FRG Relative Adjusted Weights

In the HSRV method, adjusted costs are standardized at the hospital level using hospital-specific costs—so costs for a patient at a hospital with high average costs are counted as less resource use than costs at a hospital with low average costs. The average weight or CMI is used to account for the variation in patients across hospitals.

In the HSRV method, the total adjusted cost for each case is divided by the average adjusted cost for the hospital in which the case occurred. The resulting ratio is then multiplied by the hospital's CMI to produce a hospital-specific, relative value. This relative value can be viewed as a cost that has been standardized by the hospital's own costliness, in contrast to the standard method where the cost estimate is standardized by the payment factor.

The process of calculating the weights is iterative. Initial values are chosen for the CMI of each hospital. FRG adjusted weights are then set in proportion to the average value of the hospital-specific, relative value. These result in a new CMI for each hospital and therefore new hospital-specific, relative values. The process is continued until there is convergence between the weights produced at adjacent steps, for instance when the maximum difference is less than 0.0001. Earlier work showed that the algorithm is not sensitive to starting values of the CMI (Rogowski and Byrne 1990; Carter and Rogowski, 1992).

After the first iteration, we will eliminate statistical outliers defined as cases that differ from the FRG mean by more than three standard deviations in the log scale of HSRV standardized cost.

In calculating weights, we will count transfer cases that receive less than their FRG payment according to the portion of the FRG payment that they receive. This is the same method used by HCFA in the acute care PPS.

Relative Weights for FRG-Comorbidity Groups

The next step in the algorithm is to calculate a relative weight for each relevant combination of FRG and comorbidity. The final step of the algorithm is to multiply by the normalizing constant so that the average weight per discharge is 1.

6. CASE-LEVEL PAYMENT ADJUSTMENTS

TRANSFERS

Some cases are transferred to another health care institution before the patient has received the full course of rehabilitation therapy. Most of these transfers are to acute care facilities and occur because the patient has encountered a medical condition or event requiring acute care management. A small number of transfers are from one rehabilitation facility to another, or to a chronic care hospital, and they are often at the patient's request. Transfers to a Skilled Nursing Facility (SNF) indicate that the patient has not recovered adequately to return to independent living. In some cases the patient was not able to tolerate the intense therapy required in an inpatient rehabilitation setting and the discharge occurs very quickly.

For a transfer to any kind of institution, it may be appropriate to not provide the full FRG payment when the patient receives less than the typical amount of treatment. A reduced payment that reflects the actual cost of the case is more appropriate and should reduce financial incentives to increase reimbursement by providing care in multiple settings.

It is worth noting that we do not include transfers to home health as cases that do not receive the full course of inpatient rehabilitation treatment. When patients are functioning well enough to return to the community and no longer need the intense therapy provided in the inpatient rehabilitation setting, they will often still need some lesser amount of therapy or medical care that can efficiently be provided either in the home or in an ambulatory setting. Indeed, it is much less efficient to keep the patient in the costly inpatient rehabilitation setting than to provide the therapy in an alternate site. The payment systems for the HHA, hospital outpatient department, and Part B therapy should recognize how the needs of patients who are discharged from inpatient rehabilitation differ from the needs of those who are discharged directly from acute care, but these payment systems are outside the bounds of this study.

In Carter, Buchanan, et al. (1997) we analyzed the costs of transfers to acute care and to rehabilitation hospitals and then recommended a per diem payment policy that would result in short-stay transfer cases receiving payment that approximates treatment cost. Under this policy, longer-stay transfer cases receive the full FRG payment, and payment increases smoothly with LOS until it reaches the full FRG payment. In this report, we will replicate these analyses using the new data and also examining the difference, if any, between the costs of a short stay case transferred to a hospital and one transferred to a SNF.

Our first analysis will examine how per diem costs of transfer cases varies across FRGCs and across transfer destinations, after controlling for LOS. We will define per-diem weights for

each FRGC group as the weight for a case in the FRGC divided by the arithmetic mean LOS for the FRGC. Since the case weights should be proportional to the cost of the resources used by a typical case in the group, this daily weight should be proportional to the cost of the resources used during a typical day in the FRGC. For all transfer cases that stay less than or equal to the mean LOS for the FRGC group, we will regress the log of the standardized cost of the case on dummy variables denoting the LOS, the transfer destination, and the log of the daily weight. The coefficients on the length of stay dummies show the ratio of the cost of the average transfer case with each LOS to the cost of a transfer case that stayed only one day. We will test whether the log of the cost of the transfer case is proportional to the per diem weight and whether the cost of the transfer case differs for transfers to SNFs (after controlling for FRGC and LOS).

The second analysis will develop a simple payment model which captures the major variation across both LOS and FRGC group, and, if necessary, transfer destination. This analysis will likely be similar to the payment model developed in our earlier work on the model RPPS which, in turn, built on earlier analyses of the costs of transfer cases in the acute care PPS (Carter and Rumpel, 1993). In both these cases the result was a per diem payment based on the typical cost of a day in the group plus a per case amount. For example, in the model RPPS, the most appropriate payment method was found to be a per diem amount equal to the payment for the case divided by the average LOS for the FRGC group plus an extra amount equal to 50 percent of the per diem. The payment model will show whether this formula remains appropriate given our new data and new definition of transfer and how to modify it if necessary.

OUTLIERS

Because costs of care vary for individual cases, under an RPPS hospitals would be expected to make money on some patients and lose money on others so that, on average, their payments would equal their costs. This system puts hospitals at financial risk; they will lose money if they are inefficient or if they are just unlucky and receive patients who require costlier care than average.

The RPPS can provide additional payments to outlier cases, which are cases that have high costs or long LOS relative to typical cases in their FRGC. According to the BBA, such outlier payments should approximate the marginal cost of the care beyond the cut-off point and may not exceed 5 percent of estimated total PPS payments. Such outlier payments could reduce financial risk to hospitals and reduce financial incentives to under serve extremely high cost patients. Financial risk arises from random factors—any hospital may receive more than its share of costly cases just by chance. In addition, some hospitals may consistently receive

patients that are costlier than average for their FRGC. Although other parts of the RPPS, viz., the case classification system and facility adjustments, are intended to address systematic differences across hospitals in costs, outlier payments may also help alleviate remaining differences between a hospital's expected payment per case and the cost of efficiently treating that group of cases.

We begin below by defining a measure of financial risk which we have used to analyze such risk in the acute care PPS and which shows that, in the absence of outlier payments, financial risk could be quite large in an RPPS. We then present our plan to analyze how risk is affected by the level of outlier payments. Our earlier research on the acute care PPS also showed that the best way to structure an outlier policy to reduce financial risk is to use cost outliers with a threshold based on a fixed-loss policy; this policy is described in the third subsection below. Such a policy is used in the acute care PPS. The last subsection discusses the possibility of adding a low-cost outlier policy to the RPPS.

Financial Risk

Rehabilitation hospitals are typically much smaller than acute care hospitals. The median freestanding rehabilitation hospital discharges only 477 Medicare cases per year and the median exempt unit discharges only 222 Medicare cases per year.[8] The median acute care PPS hospital discharged over 1200 patients in the same time frame. The smaller size of rehabilitation facilities suggests that they would be at higher financial risk from a PPS than acute hospitals—i.e., there would be a greater chance that their costs would exceed revenues by a substantial amount. However, the higher risk from their small size is partially offset by the greater homogeneity of the cost of cases within FRGCs than within DRGs. Our previous study (Carter, Buchanan, et al., 1997, Table 5.6) showed that, in the absence of outlier payments, the financial risk faced by the typical freestanding rehabilitation hospital under an acute RPPS would be quite similar to the amount of risk faced by the typical acute care PPS hospital in the absence of outlier payments. Because exempt units are quite a bit smaller, their risk is larger—close to that of rural hospitals under the acute care PPS. Based on this analysis, we concluded that the need for outlier payments in an RPPS is at least as great as in the acute care PPS, where outlier payments were seen to be "a key to payment equity" (HCFA, 1987).

To assess the extent of financial risk from an RPPS, we will use the following measure of financial risk under a PPS for a particular hospital. Risk is defined to be the standard deviation of annual profit around its expected value expressed as a percentage of annual revenues (Keeler

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[8] Calculated from the calendar year 1997 MEDPAR file, using provider number to define rehabilitation hospitals and provider code to define rehabilitation units.

et al., 1988). Profit is defined as Medicare revenues minus Medicare costs. We estimate this quantity by assuming that each hospital has its own population of cases that might appear for admission and that actual cases are drawn independently from this distribution. Let

s_i = an estimate of the standard deviation of profit across cases at hospital i,

n_i = number of annual cases at hospital i, and

r_i = average revenue per case at hospital i.

Then, under our assumption of a random draw of cases,

$$Risk_i = s_i/(sqrt(n_i)r_i).$$

Actual year-to-year variation in profits in the acute care PPS has been shown to be somewhat higher than the variation estimated from this model (Carter and Farley, 1993) due, at least in part, to management actions that affect costs or revenues.

This risk measure has several characteristics that make sense. Risk decreases with hospital size for hospitals with similar case mix. And the greater the variability of profit among cases, the greater the risk, since variability increases the chance that the hospital will receive so many unprofitable cases that it cannot offset its losses with gains.

Amount of Outlier Payments

The amount of funds planned for outlier payments can be viewed as the result of a tradeoff between the need for protection for hospitals and expensive patients (which argues for more outlier payments) and the need to maintain incentives to improve efficiency (which argues for limiting outlier payments). The amount of risk protection for hospitals and patients that is purchased with each additional dollar declines as more money is spent on outlier payments. Thus, a small amount of outlier funds can have a large effect on financial risk while reducing incentives for efficiency in only a small percentage of cases. In the RPPS, the percentage of funds to be paid as an outlier supplement is mandated to be no more than 5 percent, but may be less. In simulations to be described in more detail in Section 8 of this work plan, we will examine the amount of risk that hospitals face under an RPPS with varying levels of outlier payments ranging from none to 5 percent. We will examine the amount of risk reduction achieved with each increase in the amount of outlier payments. We shall also compare the remaining risk to the amount of risk in the acute care PPS.

Fixed-Loss Cost Outliers

Given the amount planned for outlier payments, Keeler et al. (1988) show that the maximum protection from financial risk possible in a case-based outlier system[9] is achieved by use of a stop-loss insurance policy where the loss amount is equal across DRGs. Under such a policy, outlier payments are made for all cases that cost more than a threshold equal to the payment amount for the DRG plus the loss amount, where both payment and loss amount are adjusted by the facility's adjustment factor. The amount of the outlier payment is then a fraction of costs in excess of the threshold, where the fraction can be viewed as 1 minus the coinsurance amount. In the acute care PPS, such a fixed-loss outlier policy has been used since FY 1995.

In the acute PPS, the fraction of total costs beyond the threshold that are paid is called the marginal cost factor. Paying more than short run marginal cost may provide an incentive to the hospital to provide more care than necessary to the outlier patient. On the other hand, paying less than average cost could put particular hospitals at a disadvantage if they have more than their share of outlier patients due to the combination of their case mix and the limitations of the case classification system (rather than due to inefficiency on the part of the hospital).

The definition of marginal cost varies with the time frame, being smaller in a shorter time frame. Therefore the BBA mandate to pay marginal cost is not completely well defined. Any reasonable definition of marginal cost would exclude capital costs for buildings, but one might also consider a variety of other costs as fixed depending on the time frame. Without further guidance about the intent of the mandate on marginal costs, there is no analytic method to determine such costs. The acute care PPS pays 80 percent of costs in excess of the threshold for both the operating PPS and the capital PPS. We will explore this factor in our simulations of outlier payments.

ATYPICALLY LOW-COST CASES

Some authors have advocated that Medicare's PPS should define short-stay outliers or low-cost outliers and pay them less than the DRG rate (e.g., Davis et al., 1990).[10] Using such a policy in the RPPS could be fair because these patients are often less costly than average for

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[9] Greater financial protection could be achieved via insurance against the total amount of a hospital's loss in a time period (Ellis and McGuire, 1988). However, such a policy would be much less effective than a case-based insurance policy at mitigating PPS incentives to under treat expensive cases.

[10] Reducing payments for hospitals with extremely low costs also could be done with a blended hospital rate in place of a case-specific low outlier payment. This is analogous to providing the payer in a capitated payment system with protection against selection with a low cost risk corridor. However, just as hospital-level insurance would not mitigate incentives to under treat expensive cases, a low cost adjustment at the hospital level would not mitigate the incentive for costly hospitals to admit

their FRGC. It would also free up funds which could then be used to increase the base FRGC payment rate. Further, it could decrease the PPS incentive to unnecessarily hospitalize patients who require much less care than average for their FRGC.[11] Such short-stay outlier payments are made in the Medicaid acute PPSs in Iowa, Michigan, New Jersey, New York, and North Dakota.[12] In analyzing the reduction in payment for short-stay outliers, it is important that the reduction amount vary smoothly with LOS or cost. Otherwise, a large difference between the outlier payment and the FRGC payment could introduce a strong incentive for hospitals to keep patients until they had exceeded the outlier threshold because they would receive a large change in reimbursement for the expenditure of relatively few resources. Carter and Rumpel (1994) suggested the form of a "low-cost outlier" policy that has the desired incentives. The first subsection below summarizes this proposal. The second subsection shows how we will explore low-cost outliers and the possible values of the parameters that determine the amount of the payment reduction for a particular case.

How a Low-Cost Outlier Policy Would Work

The key to designing a low-cost outlier policy with acceptable incentives is to avoid large discontinuities in payment that are associated with small resource expenditures. Thus, payment for low-cost outlier cases should increase smoothly with cost until a low-cost threshold is reached. To avoid any discontinuity in payment, reimbursement for low-cost outliers should equal the FRGC reimbursement at the low cost threshold.

The payment for a low-cost outlier case would be calculated as follows. First compare the estimated cost of the case, C, with the low cost threshold for the FRGC. Before the comparison, the threshold is adjusted by the facility adjustment factor. For cases with a cost less than the threshold, the total payment is reduced. To show that the payment for a case just at the threshold equals the FRGC price, we write the total payment for the case, P, as a regular FRGC payment minus a reduction in payment:

$$P = R*W*A - Z*(T*A-C)$$

Where

R = the national payment rate,

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unnecessarily.

[11] Because low cost outliers reduce the amount of profit from cases that are discharged much too early, there is some chance that it would even slightly reduce incentives for too early discharge. We believe that the effect would be slight because reasonable parameters of a low cost outlier policy would allow it to affect the decision in only a small portion of the cases where premature discharge is possible.

[12] See Carter et al. (1994) for further details. In addition, Washington state defines low cost outlier cases.

W = the FRGC weight,

A = the payment factor for the hospital,

Z = the profit reduction rate (and also the rate at which payment for low-cost cases increases with cost), and

T = the low cost threshold for the FRGC in standardized dollars.

The reason why we call Z the profit reduction rate is that it equals the fraction of the profit from keeping the costs of a case below the threshold that returns to HCFA. 1 - Z is the fraction of the profit due to below-threshold costs that is retained by the hospital. All low outlier cases earn a profit of at least (R*W - T)*A, which is entirely retained by the hospital.

The value of Z will be the same across all FRGCs and by design must be in the closed interval between 0 and 1. If Z exceeded 1, it would give the hospital a financial incentive to provide unneeded care until the low-cost threshold was reached. If hospitals value the care they give patients, then setting Z = 1 would also provide incentives for hospitals to provide care that is of some value to the patient but not cost-effective. The value Z = 0 represents the policy of no low-cost outliers.

A low-cost outlier policy is defined by three characteristics: (1) the total amount of the low-cost outlier payment deductions expressed as the percentage by which the basic FRGC payment would be increased to maintain budget neutrality, (2) Z, the profit reduction rate, and (3) a rule for determining the relative allocation of low-cost outlier payment reductions across FRGCs. Using the rule to be discussed in the next paragraph, the combination of these three decisions will determine the value of the threshold, T, in each FRGC

We propose analyzing thresholds so that all cases designated as low-cost outliers may make a minimum standardized profit that is the same in each FRGC. The amount of the minimum profit, X, depends on the outlier pool size and value of Z. The low cost threshold for the FRGC is then given by

$$T = \text{Max}\,(R*W - X, 0),$$

so that all cases with costs less than the FRGC payment minus the minimum profit are low-cost outliers. If the value of R*W _- X is negative, then the FRGC will have no low-cost outliers. Given the low-cost outlier pool size and the value of Z, this rule provides the maximum possible reduction in the variance of profit across cases.

How would a low-cost outlier payment policy apply to transfer cases? First, the transfer per diem payment is analogous to the FRGC payment—it is set so that this set of clinically defined cases receives payment that, on average, equals costs. Thus, the transfer per diem payment is preferable to a low-cost outlier reduction of the *case-level* payment. However, for logical consistency, one must consider the possibility that the transfer per diem for a transfer

case would result in a profit in excess of the minimum profit amount X. In this case, the transfer per diem should be reduced by the fraction Z of the profits in excess of X. This is accomplished by setting a low-cost outlier threshold based on the standardized transfer per diem.

Although required for logical consistency, very few transfer cases will qualify for low-cost payment reductions within reasonable ranges of the payment parameters.

Analyses

If HCFA implemented a low-cost outlier policy in an RPPS, it could provide funds that could be used to increase the basic payment rate. Whether or not this is desirable depends on the distribution of costs across cases and profits across hospitals. If there are many cases with resource needs much lower than average for their FRG, if these cases are concentrated in hospitals with relatively large RPPS margins, and if funds saved by the low-cost payment are then returned to hospitals in a larger FRG payment rate, the policy could improve the Medicare margins of many hospitals and improve equity among providers.

We will analyze the frequency of low-cost cases, excluding transfer cases, within each FRGC, where low cost is defined as a fixed amount below the average cost of the FRGC. In our earlier analyses of the RPPS, we found that there were many low-cost cases, but patterns of care may have changed this finding.

Assuming low-cost cases are reasonably frequent, we propose to analyze how the distribution of low-cost case payment reductions would be related to RPPS margins and TEFRA payments. It is possible that the answer to this question will depend on the values of the two parameters of a low-cost outlier payment policy: the total amount of low-cost outlier payment reductions (or equivalently the percentage increase in regular FRGC payments due to the low-cost outlier payment policy) and the value of Z. These two parameters jointly define a policy decision that balances the costs and benefits of a low-cost outlier policy. A reduction in the PPS incentives for efficient care of low-cost outlier patients is a weakness of low-cost outlier payments, while a reduction in incentives for unnecessary admissions is a benefit. We expect that low-cost outlier payments would increase equity for providers by adjusting for differences among hospitals in the frequency of low-cost cases. However, if it turns out that low-cost cases are concentrated in hospitals that also have a higher-than-expected number of very costly cases, then the low-cost outlier policy would decrease provider equity because it limits the ability of hospitals to offset large losses on some cases with gains on other cases.

Given a particular total low-cost outlier reduction amount, the value of Z determines whether the target low-cost payment reductions will come from small reductions in a lot of cases or large reductions in a small number of cases. Higher values of Z produce fewer low-cost

outlier cases for whom the PPS incentives for efficient care are modified. Higher values of Z also provide the least incentive for unnecessary admissions. On the other hand, lower values of Z increase the incentives for efficient care of each low-cost outlier case because hospitals keep a larger share of their cost savings.

We will examine the outcome of alternative levels of low-cost outlier payment reductions and values of Z in simulations. One of the options that we will examine is a low-cost outlier policy completely symmetric to the high cost outlier policy. In such a symmetric low and high cost policy, the low-cost outlier threshold is set as the FRGC payment minus the fixed loss amount —just as the high cost outlier threshold is set at the FRGC payment plus the fixed - loss amount. The profit reduction rate is set equal to the marginal cost factor (presumably 0.8). Just as the high cost outlier policy limits the loss that a hospital can receive from a few high cost cases, the low-cost outlier limits the profit that can be made from a few low-cost cases.

7. FACILITY-LEVEL ADJUSTMENTS

The statutory provision establishing RPPS requires an area wage adjustment. In addition, the statute gives the Secretary discretionary authority to take into account the unique circumstances of rehabilitation hospitals located in Alaska and Hawaii and to make other adjustments necessary to properly reflect variations in necessary costs of treatment among rehabilitation facilities. We will explore facility-level adjustments to the standard payment amounts that would account for cost differences beyond the facilities' control and would be appropriate to recognize as a payment parameter. In addition to an area wage index and cost-of-living adjustment for rehabilitation facilities in Alaska and Hawaii, we will explore the appropriateness of adjustments for large urban areas, the indirect costs of graduate medical education (IME) and for serving a disproportionate share of low-income patients.

In addition to examining factors that may be appropriate to recognize under RPPS, we will explore other factors that may explain costs such as the date of certification and type of facility. This analysis will help us to understand the effect of current incentives and the likely effects of RPPS. Our primary tool in these analyses will be multivariate regression with the dependent variable being the average cost per case at a particular facility. The general specification is that

C = f(CMI, WI, X), where

C = average cost per case at the facility

CMI = the case mix index

WI = wage index for the facility, and

X = a vector of additional explanatory variables that affect a hospital's costs per case, such as its teaching activities, proportion of low-income patients, etc.

WAGE INDEX

Statutory Provision

The statute requires the Secretary to adjust the labor-related portion of the PPS rates for area differences in wage levels by a factor reflecting the relative hospital wage level in the geographic area of the rehabilitation facility compared to the national average wage level for such facilities. Beginning in FY 2002, the wage index is to be updated at least every three years

based on available information on the wage-related costs incurred in furnishing rehabilitation services. The wage index adjustment is to be budget neutral.

Cost Report Wage Data

Acute care hospitals report wage information annually on Worksheet S-3 of the cost report. This worksheet was designed to support annual updates to the acute care hospital wage index. No identifiable wage data specific to rehabilitation facilities is reported. Although the instructions are not explicit, it appears that the wages attributable to ancillary services provided to rehabilitation inpatients are combined with the wages for ancillary services provided to acute care inpatients and outpatients. The wages and hours attributable to routine (room and board) services provided in the rehabilitation units are not reported as a separate line item but are combined with wages for services provided in other sub-provider components of the hospital complex (other than SNF services which are reported separately).

In our initial analyses, we will use the FY 1996 audited wage data that was used for the FY 2000 hospital wage index, that is, wage data for cost reporting periods beginning on or after October 1, 1995 and before October 1, 1996.

Wages Included in the Index

We plan to explore options for constructing a wage index instead of using an existing wage index. This is because HCFA is phasing out over a five-year period the inclusion of wages for services provided by teaching physicians, interns and residents, and non-physician anesthetists under Part B. The FY 2000 hospital wage index is based on a blend of 80 percent of an average hourly wage including these costs and 20 percent of an average hourly wage excluding these costs. The costs should be excluded from the wage index because the services are not covered under RPPS. Unlike the PPS for acute care hospitals, a transition is unnecessary for RPPS because payment for inpatient rehabilitation services has never been based on a wage index that includes these services. We will use a wage index that excludes 100 percent of the wages for services provided by teaching physicians, interns and residents, and non-physician anesthetists.

HCFA used a survey of teaching physician salaries to develop the FY2000 wage index for acute care hospitals. Only 500 of the 845 teaching hospitals completed the survey. For those teaching hospitals that did not report teaching physician salaries, HCFA removed 80 percent of the Part A physician salaries and hours. HCFA's analysis of preliminary wage data showed Part A teaching physician costs were 68 percent of total Part A physician costs. HCFA used the 80 percent offset based on industry recommendations and in order to avoid establishing an

incentive not to report teaching physician costs. In developing the payment adjustments for RPPS, however, we will use the best available wage estimates. Therefore, we plan to re-estimate the proportion of physician Part A salaries in teaching hospitals that are accounted for by teaching compensation. We will consider using this estimate to adjust the Part A physician costs and hours of non-responsive teaching hospitals.

Impact of MGCRB Reclassifications

The acute care hospital wage index reflects the geographic redesignation of certain rural areas and the reclassification of hospitals by the Medicare Geographic Reclassification Review Board. HCFA proposes to use the reclassified wage index for the hospital outpatient prospective payment system. The non-reclassified wage index is used in setting the TEFRA limits for new hospitals and in the payment systems for SNFs and HHAs.

The primary reason for consideration of the reclassified wage index for rehabilitation facilities would be to have consistent wage areas for all services provided by a hospital paid under a prospective payment system. It could be argued that any reclassifications should apply to all portions of the hospital complex and that a single hospital should not be considered as being in more than one wage area. At the same time, adoption of the reclassified wage index would extend policies that may not have a strong analytic basis. Using the reclassified wage index would raise the issue of whether, as a matter of equity, freestanding rehabilitation hospitals should also be allowed to request reclassification to another geographic area. It could also complicate the long-term goal of creating a more consistent payment system for post-acute care.

We plan to assign hospitals to MSAs based on their actual geographic location. Although we will use a pre-reclassification wage index, we will explore the impact of our approach. We will identify the hospitals with rehabilitation units reclassified by the MGCRB for FY2000 and we will determine the difference between the reclassified and pre-reclassified wage index for these hospitals. Given the complexity of constructing the reclassified wage index, we will use the existing FY 2000 reclassified and pre-reclassified wage indices for this analysis.

Specification of the Adjustment Factor

HCFA has used three approaches to specifying an adjustment for geographic differences in costs.

- In the acute care hospital operating PPS, the labor-related portion of the standardized amount (71.1 percent) is adjusted by the wage index. The labor-related portion is determined from cost report data and is established in conjunction with the hospital market

basket. The labor-related share for TEFRA hospitals is also 71.1 percent. Although excluded hospitals have a higher proportion of salaries and benefits (63.7 vs. 61.4 percent), they have relatively lower "other labor-intensive costs" (5.4 vs. 7.3 percent).

- In the acute care hospital capital PPS, the geographic adjustment was determined through regression analysis using total costs (operating and capital) per case as the dependent variable. The geographic adjustment factor is expressed in exponential form in order to apply to the entire payment. Payment increases approximately 6.8 percent for each 10 percent increase in the hospital wage index.

- In the proposed rule for hospital outpatient PPS, HCFA estimated the percentage change in total costs attributable to a one- percent increase in the wage index. Depending on the regression model, the coefficient varied from .51 to .68. HCFA proposed to use a 60 percent labor-related share and to apply the wage index to that portion of the standard payment amount.

In our earlier work, we used the capital-PPS specification to determine the adjustment for geographic differences in cost. The PPS for rehabilitation facilities covers all costs, both operating and capital costs. We will examine all three specifications in our regression analyses.

Long-Term Refinements

Given the statutory language regarding a wage index, consideration should be given to methodologies that might incorporate rehabilitation hospital wage data into the adjustment for geographic cost differences. The conventional wisdom is that rehabilitation facilities have a higher proportion of therapy salaries and that there is less geographic variation in these salaries than other hospital wages. The utility of sources such as the AMRPA survey, the survey conducted by the University of Texas, and BLS will be explored. We will explore what available wage data indicate about how occupational mix varies relative to acute care hospitals and the effect the variation may have on measurement of relative wage levels across geographic areas. We will also consider how external data on rehabilitation hospital wages might be incorporated into the wage index.

The excluded wage data that is collected as a separate line item (Worksheet S-3, Part II, line 8.01) includes all areas of the hospital subject to acute care PPS, e.g., other long term care facilities, psychiatric units, home health agencies, outpatient rehabilitation facilities and home dialysis. It also includes costs for nursing and allied health education. Many of these services involve the skilled personnel who are commonly found in rehabilitation facilities. However, this line item does not include ancillary service provided to the inpatients of excluded units. As a long-term refinement, we will consider combining the excluded wage data with data for the acute care hospitals. This would have the advantage of including all available cost report data for rehabilitation facilities in the wage index. However, the acute care hospital wage index may be a better measure of geographic differences in wage levels for rehabilitation facilities than an

index which is influenced by wages for a wide variety of non-hospital services which are not consistently provided under the ownership and control of the hospital. To investigate this issue, we will construct a wage index using all wages reported for the hospital complex. We will compare this wage index to the acute care hospital wage index and use regression analysis to determine which index better accounts for cost differences across geographic areas.

LARGE URBAN AREAS

When separate rates for urban and rural hospitals were eliminated under the PPS operating system, the law retained a 1.6 percent add-on for large urban hospitals (hospitals located in MSAs with 1 million population or NECMAs with 970,000 population or more). Through regression analysis, a 3 percent add-on was established for large urban hospitals under capital PPS. No add-on has been proposed for the hospital outpatient PPS because large urban hospitals were not significantly different from other urban hospitals.

Our earlier study found the large urban effect was not significant in explaining total costs per case. We will re-examine this issue in our payment regressions.

Alaska and Hawaii

A cost-of living adjustment is made under the acute care PPS for hospitals located in Hawaii and Alaska. The current adjustments are 1.25 for Alaska and 1.225 for Hawaii. There are three rehabilitation facilities in Hawaii and one in Alaska.

We will use payment simulations to assess whether a cost-of-living adjustment would improve payment equity for facilities in Alaska and Hawaii. An average payment-to-cost ratio that is significantly less than 1.0 would suggest that some adjustment for higher costs in Hawaii and Alaska would be appropriate.

INDIRECT TEACHING COSTS

Specification of Teaching Intensity

HCFA has used three approaches to the issue of the indirect teaching adjustment.

- The early regressions looking at this issue for the acute care operating PPS used the ratio of residents-to-beds. This methodology was incorporated into the payment formula specified by law. The FTE count includes resident time spent in all areas of the hospital subject to the prospective payment system, outpatient areas, and non-hospital settings where the hospital incurs substantially all of the training costs. The bed count includes all beds staffed and maintained to provide inpatient care covered under the PPS system.

- For the acute care capital PPS, the teaching adjustment was determined through regression analysis using total costs per case as the dependent variable and residents-to-

average daily census as the independent variable. The resident count is the same as under operating PPS. Average daily census was considered an improved measure of patient load subject to less manipulation.

- For the hospital outpatient PPS, HCFA modified the resident-to-average daily census variable to reflect the ratio of residents to combined inpatient and outpatient utilization. The ratio of inpatient costs per day to outpatient costs per unit for each hospital was used to convert outpatient services into inpatient day equivalents.

Our earlier work used the capital-PPS teaching intensity measure and found no teaching effect on cost. One reason might have been some data errors and inconsistencies in the resident count (resident time spent in the inpatient routine area only for units versus time spent in inpatient and outpatient areas of freestanding hospitals). Ideally, the resident count should be consistent with the utilization measure. The ratio of FTE resident time in the inpatient routine area to average daily census would be the most direct measure of inpatient teaching intensity. However, using this measure in the payment formula could have the unintended consequence of discouraging training in ambulatory settings. The ratio of total FTE residents in the hospital complex to adjusted average daily census may be preferable from a policy perspective. (We note that an FTE count associated with both the inpatient routine and ancillary services provided rehabilitation inpatients cannot be determined directly from the cost report data and would involve counting the residents in ancillary areas of acute care hospitals twice: once under acute hospital PPS and once under RPPS.) Therefore, we plan to examine the effects of teaching on costs per case using both measures of teaching intensity.

Data Issues

As explained above, we would like to measure two levels of teaching activity. The first measure would be based on the time residents spend in the inpatient rehabilitation unit. It would exclude the time residents spend in outpatient clinics or ancillary service areas of the hospital. The second measure would be based on the total amount of time residents spend working throughout the hospital complex. There are issues in getting the needed data for either measure.

The cost report public use files do not provide counts of interns and residents assigned to the rehabilitation units of acute care hospitals. Resident assigned time to rehabilitation units, however, is available on Worksheet S-3, Part II of the cost report. We would like to use this information in our analysis. If it is not available, we will use an approach that is similar to the approach we used in our earlier study. We will assume that the difference between the total FTE resident count for the facility and for the hospital is attributable to residents assigned to the rehabilitation and psychiatric units. We will apportion the difference based on the ratio of the

number of resident slots in physical medicine and rehabilitation to the combined number of resident slots in physical medicine and psychiatry using the AMA Directory of GME Programs.

For freestanding rehabilitation hospitals, our challenge is to obtain a count that is limited to the time residents spend in the inpatient unit. The resident count reported on Worksheet S-3, Part I includes the time spent in both the inpatient and the outpatient areas of the hospital. This is in contrast to the time reported for rehabilitation units (which includes only the time spent in the inpatient routine area). Assigned time by patient care cost center is reported on Worksheet B-1 of the cost report (which is not part of the public use file). We would like to use this information in our analysis. If it is not available, we will reduce the FTE resident count at each freestanding rehabilitation hospital by 30 percent. This is the estimated training time spent by residents in physical medicine in outpatient settings as reported on the AMA's on-line FRIEDA system.

For the measure based on the total number of residents working at the hospital complex, the appropriate resident counts are readily available from the information on Worksheet S-3. The challenge is to develop an appropriate measure of total services furnished by the institution. For the outpatient PPS proposed rule, HCFA computed equivalent inpatient days for outpatient services by dividing the average cost per diem by the average cost per visit and dividing the result into the total number of visits. Adding the result to total inpatient days and dividing by the number of days in the cost reporting period produces an adjusted average daily census. This approach requires using outpatient bills since the cost report does not capture the number of outpatient visits. In lieu of developing our own equivalent inpatient days, we plan to use the counts developed by HCFA and produced as part of the outpatient PPS impact file.

LOW-INCOME PATIENTS

Policy Context

Under acute care PPS, the disproportionate share adjustment for serving low-income patients has not had a consistent policy rationale. Initially, the Secretary had the authority to provide for an adjustment to compensate hospitals for the higher costs associated with serving low income patients. When the Secretary did not adopt an adjustment administratively, the Medicare law was amended to specify an adjustment for inpatient operating costs. The adjustment takes into account:

- The percentage of Medicare inpatients who are entitled to SSI.
- The percentage of total patients who are entitled to Medicaid but are not entitled to Medicare.

The formula is intended to achieve a geographic balance between States that have relatively generous Medicaid eligibility and low-income States with more restrictive programs. HMO enrollees are included in the DSH patient percentages. The patient percentage criteria for DSH payment vary for urban hospitals and for rural hospitals by bed size categories, and for sole community hospitals and rural referral centers.

HCFA has generally maintained that the DSH adjustment is intended to cover only the higher costs associated with the care of Medicare beneficiaries in hospitals serving a disproportionate share of low income patients. For example, the DSH adjustment in the acute care capital PPS was determined through multi-variate regression analysis based solely on the relationship of the DSH variables to hospital costs per case. ProPAC, on the other hand, viewed the DSH adjustment as a policy adjustment independent of hospital cost. ProPAC (now MedPAC) views the DSH payment as a Medicare subsidy to assist hospitals in assuring access to quality care for low-income Medicare beneficiaries.

With the growth of managed care, Medicaid/SSI days are no longer a good proxy for a hospital's uncompensated care costs. Under Medicaid managed care, care is moving to the outpatient setting and hospitals that are not traditional safety net providers are providing care to Medicaid patients. Also, the increase in Medicare managed care enrollees decreases the number of Medicare inpatient discharges eligible for the DSH payments.

The Balanced Budget Act reduced operating PPS DSH payment by five percent over five years. In addition, the law required a Report to Congress containing a revised formula for DSH payments. Drawing on work by ProPAC, the formula is to:

- Establish a single threshold for hospitals serving low income patients
- Consider the costs incurred by hospitals in serving Medicare patients who are entitled to SSI; and,
- Consider the costs incurred by hospitals in serving Medicaid patients who are not entitled to Medicare.

The Secretary's report to Congress has not been released. MedPAC recommended in its March 1998 report that DSH payments be distributed according to each hospital's share of low-income patients and volume of Medicare cases. MedPAC would calculate low income share based on percentage of patient costs for:

- Medicare patients eligible for SSI
- Medicaid patients not entitled to Medicare
- Patients sponsored by other State and local indigent care programs; and,
- Uninsured and underinsured patients represented by uncompensated care costs

MedPAC would establish a minimum threshold (e.g. 50 percent of hospitals would be eligible for an adjustment) and make the formula change budget neutral to amounts currently being paid for DSH.

It may be appropriate to separate the analysis of the effects of DSH on hospital costs and DSH payments as a subsidy for low-income care. This would allow one adjustment for the effects of DSH on Medicare costs as part of the payment formula and an additional policy adjustment to serve as a subsidy for serving non-Medicare low-income patients. Consistent with the first use of DSH payments, our earlier study examined the effect of Medicaid on Medicare costs per case and found it to be significant. We propose to continue to concentrate our analysis efforts on this aspect of DSH. In doing so, we will examine measures that would fit within the BBA parameters. We believe that the question of the use of DSH payments as a general subsidy for care for the low income population requires resolution in a much larger context than that of rehabilitation care and is thus outside the scope of this project.

Data Issues

Information on a patient's entitlement to SSI benefits is confidential and is not available from the inpatient bill. HCFA sends the MEDPAR acute care bills to SSA for a match with SSI eligibility files. The percentage of Medicare inpatients entitled to SSI is returned to HCFA and the intermediary. If we are able to obtain the SSI percentage for inpatient stays in rehabilitation facilities timely, we will evaluate the current method for determining low-income patient share. If not, we will explore the possibility of imputing an SSI percentage based on the facility's percentage of non-Medicare patients who are entitled to Medicare. We will examine the relationship between the Medicare SSI percentage and the non-Medicare Medicaid percentage among the acute care hospitals within a state. If we determine a consistent relationship exists, we will further analyze the SSI percentage for Medicare patients in rehabilitation facilities using the Medicaid utilization data reported on the cost report.

Specification of the Adjustment for Low-Income Patients

RAND's earlier regression analysis found the percentage of Medicare patients who were entitled to Medicaid was significant. An adjustment based solely on Medicaid status could be either a patient-level adjustment (i.e., a higher payment for the individual case) or a facility-level adjustment. An adjustment that takes SSI into account can be only a facility-level adjustment since neither the hospital nor the intermediary processing the claims can establish an individual patient's entitlement to SSI. If an individual level adjustment were used, no DSH threshold would apply and there would be a reduction in outlier payments for the case.

Given the BBA mandate, we believe it is important to evaluate a facility-level adjustment that takes into account the current method for defining the DSH patient percentage. However, we note that under the current method, a hospital's DSH patient percentage does not represent the percentage of low-income patients within the facility. This is because it is the sum of the percent of Medicare patients who are on SSI and the percent of total patients who are Medicaid (non-Medicare) patients. If addition to examining the current formula, we will explore two alternative measures of low-income share. These are:

- The sum of Medicare SSI days and non-Medicare Medicaid days as a percent of total inpatient days; and,
- Medicaid (including days for dual eligibles) as a percent of total inpatient days. For this measure, we will use the UDS data to identify the percentage of Medicare patients who are also entitled to Medicaid.

As part of our analysis, we will specifically examine whether there is empirical support for a single threshold that would apply to all rehabilitation facilities.

OTHER FACTORS AFFECTING COST

In addition to examining factors that may be appropriate to incorporate into RPPS, we will explore the effect of other factors on rehabilitation facility costs Factors that we will consider include:

- Urban/rural status
- Size
- Capital-related costs
- Free-standing/unit of acute care hospital
- Time period for certification
- Type of control

Our earlier work found that the type of facility and time period for certification affected cost. Freestanding hospitals are more expensive than exempt units of acute care hospitals and new facilities are more expensive than facilities that have been in existence since the inception of PPS. We will explore through payment simulations the implications of controlling for one or more of these variables in our multivariate regressions establishing the payment formulas. If we do not control for a variable that has significant effect on cost, we will load the effect onto the variables that are in the payment formula (Sheingold, 1990).

MULTIVARIATE REGRESSION ANALYSIS

We will use multivariate regression to examine factors that may explain variation in costs per case. We plan to use pooled data from cost reports beginning in FY 1996 and FY 1997 for a matched set of hospitals. We believe this may provide more stability in the payment adjustments than using data for a single year. Our dependent variable will be each facility's average cost (operating and capital) per case. As in our earlier study, we will use the natural logarithm to transform cost and examine different specifications. Because each payment is proportional to the FRG weight for the case, we will use CMI-adjusted costs per case.

We will examine whether the payment coefficients are sensitive to whether the payment regression is facility-weighted or case-weighted. Facility-weighted regressions have been used in acute care PPS. Case-weighted regressions should be more efficient. They account for the fact that there is more random variation in data from small facilities and produce minimum variance unbiased estimates of the coefficients. Case-weighted and hospital-weighted regressions produced similar empirical results in our earlier work on RPPS.

We will perform a set of evaluation regressions to understand the various factors affecting costs per case. We will also perform a set of payment regressions using only those variables that measure concepts clearly suitable for payment and currently used in acute care PPS: the wage index, teaching intensity, proportion of low income patients, and an indicator for large urban status. We will determine which potential payment factors are significant. To assess the appropriateness of the payment adjustments indicated by the regression coefficients, we will simulate payments using these adjustments. (See Section 8.) We will compare the payments to FY 1997 costs per case. These simulations will help us assess whether we should control for other correlates of cost that are probably not suitable for payment, such as facility size and length of certification in our payment regressions.

8. SIMULATIONS AND IMPACT ANALYSES

Based on the preceding analyses, we will design a small set of alternative RPPSs. Each member of the set will be designed to test individual features of an RPPS such as the amount of outlier payments or a specific set of facility adjustments. We will then simulate payment for each of these alternative RPPS under the assumption that changes in details of the payment method would not affect behavior. Each simulation will expend exactly the same amount of funds (to within one dollar per case).

DATA

Our simulations will examine payment in each hospital's first year under the RPPS, when payments are blended with the TEFRA payment, and after the phase in is completed, when payment will be based solely on the RPPS.

The RPPS payment will be based on the CY 1997 cases in the merged MEDPAR-FIM file described in Section 2. This contains patient level case mix data for only the subset of the rehabilitation facilities that provided FIM data to either the UDSmr or to Caredata.com, and is missing some cases from most facilities.

The simplest method of accounting for the missing data would be to stratify the population of rehabilitation facilities according to hospital characteristics that we find are related to case mix such as free-standing vs. exempt unit, number of annual Medicare rehabilitation cases, and/or type of control. Then we can look on our sample as a representative portion of each hospital cell and weight each case in our merged MEDPAR-FIM database by the fraction of cases in that cell in the rehabilitation universe divided by the fraction of cases in that cell in our sample.

We shall also explore the possibility of using MEDPAR information to infer case mix at hospitals with missing FIM data, including the hospitals for which we have only partial FIM data. The information which is available includes: (1) the principle diagnosis and major procedures for the acute stay which preceded the rehabilitation stay, which should predict RIC, (2) diagnoses from the rehabilitation stay which should indicate comorbidity status for the case, (3) the discharge destination of the rehabilitation stay which should tell us whether the case is a transfer, and (4) the LOS of the rehabilitation stay, which combined with RIC, comorbidity, transfer status, and hospital characteristics may predict FRGC, outlier status, or FRGC weight. We will explore the accuracy with which these data predict case mix within our merged MEDPAR-FIM data set. If the predictions are reasonably accurate, we could then apply these prediction equations to cases outside our linked sample.

HCFA will provide us with the expected TEFRA payment rate at each rehabilitation facility in the hospital's fiscal year that will begin during the FY 2001. To the extent possible, these rates will reflect: (1) expected inflation in costs from the latest available cost report until a simulated common midpoint of the FY at April 1, 2001, (2) all BBA limitations on the similarly inflated target amounts, and (3) corrected, inflated, target rates for hospitals that rebased in their fiscal year that began in FY 1998.

In addition to payment, the simulation needs to estimate the cost of each case. The cost estimates for each case will be inflated from the date of discharge to the corresponding date in FY 2001. The rate of inflation will correspond to that used by HCFA to estimate costs for TEFRA payments.

One issue is whether to assume an average cost per case increase at each hospital or whether the increases should be drawn randomly and constrained so that the average increase equals the expected amount. HCFA has used both in the past.

PAYMENT FORMULAS

The following examples are based upon our preliminary assumptions:

The FRGC payment for a discharge in hospital i in FRGC k is given by

$$F = R^*A_i^*W_k,$$

where R is the national payment rate, A_i is the facility payment adjustment, and W_k is the FRGC weight. R will be chosen to meet the statutory expenditure target, as estimated by the OACT.

The weights in our base case will be calculated using the cost-based HSRV method. The payment factor will be derived from the analyses in Section 7 and will definitely include an adjustment based on the acute hospital wage index for the metropolitan area or rural area of the state containing the hospital, and may include adjustments for DSH and/or teaching.
The simulated case payment includes a fixed-loss outlier policy with the loss threshold, L, chosen so that a fixed percent of total FRGC payments would be made as outlier supplements. The outlier threshold for a case in hospital i in FRGC k is calculated as

$$T_{ik} = R^*A_i^*W_k + L^*A_i.$$

The cost of the case, C, is estimated by multiplying the charges for the case by a cost to charge ratio calculated from the hospital's most recent available cost report. If this cost exceeds T_{ik}, then the case receives an outlier payment which is added to the FRGC payment:

$$OUT = 0.8^*(C - T_{ik}).$$

If the simulated policy includes a low-cost outlier reduction in payment that is symmetric to the high cost outlier policy the following rule will be used. The minimum profit for cases subject to a low-cost outlier payment reduction, X, is set equal to the high cost fixed loss amount, L. Alternative values of X may also be simulated. The low-cost outlier threshold for an FRG is set at

$$LCT_{ik} = R^*A_i^*W_k - X^*A_i.$$

Just as for a high cost outlier, the cost of the case, C, is estimated by multiplying the charges for the case by a cost to charge ratio calculated from the most recent available cost report. If this cost is less than LCT_{ik}, then the FRGC payment is reduced by the low-cost outlier amount:

$$LCOUT = 0.8^*(LCT_{ik} - C)$$

The total RPPS payment for non transfer cases is then given by:

$$F + OUT - LCOUT$$

Transfer cases will receive a per diem payment plus a per case payment, which accounts for the fixed costs of the case. The amount of each will be based on the analyses that were described in Chapter 6. The transfer case payment will be capped at the FRGC payment for the case. For example, in Carter, Buchanan, et al. (1997), the transfer case received the minimum of the FRGC payment and a per diem payment equal to the FRGC payment divided by the arithmetic mean LOS for the group plus one-half day per diem.

In simulations of the first year of the system, the RPPS case payment will be blended with the TEFRA payment for each hospital. So, the payment for a case will be one-third of the RPPS case payment (after relevant outlier and transfer adjustments) and 2-thirds of the hospitals per case TEFRA payment.

OUTPUT

We will evaluate each simulation with respect to a variety of outcomes.

Accuracy at the Case Level

The accuracy with which the RPPS matches payment to cost at the patient level is measured by a univariate regression of the log of the cost of each case on the log of the total payment amount for the case (including outlier and transfer payments). The statistics from this regression that will be reported for each simulation include the R-Squared and the coefficients and their standard deviation. The coefficient on the on the payment should be close to 1.

Accuracy at the Hospital Level

The accuracy with which the RPPS matches payment to cost at the hospital level will be measured by a univariate regression of the average cost per case at each hospital on the average payment per case for that hospital.

We will be particularly interested in the extent to which facility adjustments and different levels of outlier payments and low-cost outlier payments improve the match of costs to payment at the hospital level. If low-cost outliers significantly improve the match of cost and payment, it would show that these low-cost cases are not randomly distributed across hospitals but rather are concentrated at some hospitals that would, in the absence of low-cost outlier payment reductions, make more than their costs.

Payment for Groups of Patients

We will describe the kinds of cases and hospitals that receive outlier payments and the effect of high cost outlier payments on reducing risk. In each simulation, we will calculate the percent of discharges that receive a high cost outlier payment and that receive a reduction in payment as low-cost outliers. Other statistics to be examined include the average outlier payment, average low-cost outlier payment reduction, the distributions of the payment to cost ratio of each type of outlier case, and a comparison of average payment for each case compared to average TEFRA payment.

We will also present the payment to cost ratio and change in TEFRA payment for transfer cases, by destination. Finally, we will examine these same payment statistics for patients with comorbidities and by demographic characteristics such as age and sex.

Payment for Groups of Hospitals

We will present payment to cost ratios and a comparison of PPS payments and TEFRA payments for groups of hospitals defined by:

(1) rural, urban, and large urban location

(2) Census region,

(3) free-standing versus exempt unit

(4) one or more measures of fraction of the population that is low income,

(5) teaching status,

(6) size of Medicare rehabilitation program, and

(7) age of facility.

9. IMPLEMENTATION ANALYSES

In this section of the work plan, we describe proposed analyses that address specific issues in implementing the proposed RPPS. In the first subsection we address the use of the MDS-PAC rather than the FIM instrument to code FRGs. In the second subsection, we address coding issues and their implications for setting the payment rate and for developing instructions for using the MDS-PAC. The last subsection discusses analyses that relate to refinement of the RPPS in the years following initial implementation in FY 2001.

USING MDS-PAC TO IMPLEMENT THE PAYMENT SYSTEM

The MDS-PAC was designed to be used for all post-acute care in a variety of settings including (at least) inpatient rehabilitation, Skilled Nursing Facilities, and Long Term Care hospitals. It is hoped that it will eventually be used in multiple PAC sites, allowing one to compare case mix, cost, and outcomes across different kinds of facilities. Because of this long term goal, it is desirable for HCFA to start the RPPS using the MDS-PAC. If, instead, HCFA started the RPPS using the FIM and then later switched to the MDS-PAC, it would cause substantial unnecessary effort in hospitals that do not now regularly code the FIM and/or process it electronically.

Although it is desirable, a priori, to use the MDS-PAC there remain some issues that need to be investigated to ensure the feasibility of using the MDS-PAC to assign FRGs and comorbidity indicators.

Determining RIC

The draft of Version 1.0 of the MDS-PAC (dated July 21, 1999) asks for the 'primary impairment for which patient is admitted (code one only)'. The FIM instrument (in the UDSmr version) asks for the impairment group that is 'the primary reason for admission to the rehabilitation program' and allows only one response. It is likely that these two phrases are similar enough that the responses are measuring the same concept.

The respondent to each instrument, the FIM and the MDS-PAC, selects the answer to this question from among lists provided in the instrument. There are some impairment codes on the FIM that do not appear on the MDS-PAC and that are required to assign RIC and therefore to assign FRGs. For example, there is only a single quadriplegia code on version 1 of the MDS-PAC while version 2 of the FRGs distinguishes between quadriplegia (and other spinal cord injury) due to trauma and others. As another example, there is only a single amputation code on version 1 of the MDS-PAC while version 2 of the FRGs distinguishes

between lower extremity amputations and others. The clinical consultants on our project will determine which causes of impairment should be added to the MDS-PAC instrument in order to assign FRGs.

Another problem with the list from which respondents to version 1 of the MDS-PAC select primary impairment is that it contains many diagnoses that are not impairments and are not appropriate reasons for a rehabilitation stay. Examples include: diabetes, hypertension, and depression. We will have the clinical consultants to our project develop an exhaustive list of the diagnoses that are not appropriate as the primary impairment.

Should an inappropriate diagnosis be, presumably incorrectly, coded as the primary cause of rehabilitation, it would be impossible to assign FRG. These diagnoses might very will be the primary reason for admission to a non-rehabilitation facility, even for patients who require some rehabilitation therapy. Therefore it would not be appropriate to remove them from the instrument. However, the grouper that assigns FRG should classify such cases as ungroupable (and therefore not payable) until the coding is corrected.

Determining Motor Score and Cognitive Score

The FIM motor items are largely found on the MDS-PAC instrument, but with a reversed scale. On the FIM, item responses run from 1 to 7 and 1 denotes most dependent. On the MDS-PAC, item responses typically run from 0 to 6, but 0 is most *independent*.[13] There are also slightly different verbal descriptions for intermediate points on the scale and more detail about some issues such as continence on the MDS-PAC.

The similarity of the two instruments on motor items suggest that it should be possible to construct a very reliable predictor of FIM motor score from the MDS-PAC and use this for FRG assignment.

The cognitive score FIM items are not replicated, but nevertheless highly related information appears to present. For example, the FIM item on expression rates independence on a scale from 1 to 7 with a decision tree that relates to type of assistance required to express complex and basic ideas. The MDS-PAC instead asks for 3 answers related to mode of communication, making oneself understood, and speech clarity. In this and other item areas it should be possible to construct a mapping from the MDS-PAC items to an estimated FIM item score and then to the FIM cognitive score.

With mappings from the MDS-PAC to the FIM motor and cognitive score, we will be able to develop rules to assign FRGs from the MDS-PAC instrument. Although the mapping of the cognitive score will be less precise than the mapping of the motor score, the cognitive score

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[13] Bladder continence runs from 0 to 5.

is much less important than the motor score in defining FRGs. In our preliminary FRGs (Table 3.2), only 2 RICs split on cognitive score and both only split once and both split at very high levels of the cognitive score. Thus our mapping to the FRGs may be quite good.

In order to develop the mapping from the MDS PAC to the FRGs, we will need data on cases that have been coded with both instruments. The rehabilitation cases used for field tests of the MDS-PAC instrument can provide the basis for developing the algorithm to assign FRGC. Some hospitals that participated in the field test(s) also routinely code the FIM and, for at least some of the data, it should be possible to link the MDS-PAC instrument data to the FIM instrument data. This is necessary to test the effectiveness of any theoretically derived rules.

Determining Comorbidities

We use the diagnoses coded on the hospital discharge abstract to determine comorbidity status. For ease of implementation, HCFA wishes payment amount to be determined from the MDS-PAC instrument. The MDS-PAC piloted instrument allows the respondent to note any diagnoses that are present and distinguishes between those for which active treatment is received and those that are just monitored. A check list of frequent diagnoses is provided, but room is available for adding other ICD-9-CM codes.

In practice, the information available may depend on who does the coding. In some institutions, these diagnoses may be assigned by professional medical record technicians who normally code the hospital discharge abstract. These technicians are trained in the minutia of the ICD-9-CM coding system and keep up with the annual changes in it. In other institutions, caregivers will do the coding.

If feasible, we would very much like to be able to compare diagnoses assigned in the MDS-PAC with those found on the discharge abstract for the same patient.

Lead Time for the Use of MDS-PAC

One caveat to the accuracy with which the MDS-PAC can predict FRGCs is related to the amount of lead time that rehabilitation facilities will have to learn the intricacies of the MDS-PAC and to code it correctly. The early availability of the instrument and its instruction rules are crucial to accurate coding and therefore accurate payment. To the extent possible, HCFA should also actually collect the MDS-PAC data prior to implementation of the payment system so that hospitals and intermediaries can test out their data collection and data correction systems.

EXPECTED CHANGES IN CODING

The BBA mandates that the RPPS be budget neutral in its first years of operation —i.e., the RPPS should pay a total amount equal to one-third of what the TEFRA payments would be in the absence of the RPPS payment. In order to do this, HCFA must set a payment rate that accounts for the average case weight for cases that are paid under the RPPS.

If hospitals change the way they code cases, then the average case weight will differ from the estimate derived from the FRGCs assigned to our sample of cases. HCFA might account for expected changes in coding in setting the initial rates or, instead, might plan to adjust the rates to account for observed changes in coding. We will analyze the potential for coding changes in several areas.

Comorbidities

We believe that comorbidities may be frequently omitted from MEDPAR records of rehabilitation discharges. Rehabilitation facilities are asked by Medicare to code comorbidities and complications, but this information was never used for any purpose. Thus it is likely subject to errors, particularly errors of omission. When hospitals are paid according to these comorbidities, they will quickly improve their coding. Indeed, many of the changes in coding in response to the PPS were improved coding rather than coding for gaming purposes (Carter, Newhouse, and Relles, 1991).

In the early years of the acute care PPS, the proportion of cases with coded comorbidities increased dramatically, probably in large part because of earlier undercoding. In the beginning of FY 1988, the DRG system was changed so that, for the first time, patients who were 70 or older were put into a different DRG if they had a comorbidity than if they did not have a comorbidity. The result was a dramatic increase in the proportion of patients over 69 with comorbidities. A research study used "gold standard" coders to recode a random sample of hospital medical records from both FY 1987 and FY 1988. They found that the comorbidities coded in FY 1988 were usually correct, but that many of the medical records for 1987 cases coded by the hospitals without comorbidities contained evidence that the patient had a comorbidity—since the comorbidity did not affect payment it was not coded. Similarly, we suspect that the Medicare records for our sample of rehabilitation cases omit many existing comorbidities.

Carter, Buchanan, et al. 1997 (Section 4) provided evidence that comorbidities were undercoded in their 1994 data. They hypothesized that errors of omission might be less frequent in exempt units than in free-standing facilities because exempt unit discharge records may be frequently coded by the same medical record technicians that code the hospital's PPS

records. They found that exempt units do code a higher fraction of their cases as having comorbidities (25.5 percent versus 16.5 percent for free-standing facilities) Further, they showed that the difference in resource use between cases with comorbidity and cases without comorbidity is greater for cases in exempt units than for cases in free-standing facilities. We will verify if the same situation holds in our data which covers many more hospitals.

Further, the acute care PPS record may allow us to estimate the extent of undercoding of the comorbidity variable. Since the MDS-PAC record of comorbidities may show only comorbidities that were present within the first 3 days of admission, most, if not all, should have also been present during the acute stay that preceded the rehabilitation stay. By examining the frequency with which chronic comorbidities are listed in the acute stay and then not listed in the rehabilitation stay, we can get an upper bound on the rate at which comorbidities are omitted in our data. It is an upper bound, because some comorbidities and complications will be controlled during the acute stay and thus not be relevant to the rehabilitation stay. By examining the FRGs assigned to the cases with missing comorbidity information, we can also get an upper bound on the increase in the CMI that would occur if all the omitted comorbidities were coded.

We can get a lower bound on the extent to which comorbidities are omitted in our data by assuming that exempt units code perfectly and that only free-standing units omit comorbidities. We can further assume that whether comorbidities are controlled during the acute stay does not depend on whether the case is sent to a free-standing hospital or to a unit and thus whether the case has a comorbidity at admission to rehabilitation can be modeled from acute care data for cases in excluded units. This model can then be applied to the acute care data for the cases in free-standing hospitals to determine the frequency of omission of comorbidities and its effect on the CMI.

HCFA may choose to use the results of this analysis in setting standardized payment rates.

Coding of RIC

There is also a possibility of miscoding of rehabilitation impairment categories (RICs). The Clinical and Functional Status technical advisory panel of our first study believed that, with the current set of RICs, some cases provide opportunities for alternative assignment, such as a patient with neck pain due to osteoarthritis who could be classified in an arthritis category or in the pain category (Carter et al., 1997).

In order to investigate this issue further, we will examine the relationship between the principle diagnosis of and, major procedures performed during, the acute stay that precedes

rehabilitation and the RIC. This analysis will show the extent to which apparently similar patients are classified into different RICs. If necessary, we will further compare the average costs of ambiguous cases to the average cost in their FRG and the average cost of cases in the FRG that they would be assigned under an alternate RIC.

This analysis will likely provide guidance about instructions for assigning the primary cause for the rehabilitation hospitalization.

Coding of the FIM

As the advisory panel for our earlier study suggested, the rules for scoring each FIM item would benefit from further specificity. Although the developers of the MDS-PAC have specific guidelines for scoring the FIM questions, there is likely still some judgement required for some items in some cases.

The use of FRGs rather than raw FIM scores to characterize patients should mitigate the effect of miscoding of FIM items. Since the FRGs are based on ranges of FIM motor and FIM cognitive scores, and since we may consider limiting the number of FRGs in each RIC, the only coding errors that will affect FRG assignment are either large errors or scores near the FRG cutpoints.

We will analyze data, where available, to assess the reliability and comparability of the MDS-PAC and FIM instruments.

USE OF MDS-PAC TO REFINE THE PAYMENT SYSTEM

The initial implementation of the RPPS will use the FRGCs as they are assigned from the MDS-PAC instrument. Here we briefly touch on the research we will do in later stages of the project that relate to refinement of the RPPS in the years following initial implementation in FY 2001.

The MDS-PAC instrument contains a wealth of information that is not on the FIM that may both predict resource use and be appropriate for payment. Some of the additional information provides a better description of cognitive functioning, which is the area which the technical panel in our first study believed to be weakest in the FIM. With better measures of cognitive function it may turn out that this aspect of independence is a much more important predictor of resource use than it appears to be when one analyzes only FIM data. The MDS-PAC also better describes the patient's mood and behavior patterns.

For some comorbidities, the MDS-PAC allows one to distinguish between patients receiving active treatment and those whose condition is only monitored. This too may be a useful predictor of resource use that is appropriate for payment.

The MDS-PAC also provides information that may not be directly related to payment. Because of the inefficiencies created by the incentives in a pure fee for service payment system, we would not expect to pay based on most treatment items. A more ambiguous situation arises with respect to using information about the goal of rehabilitation and resources available for discharge. With the former there are issues of accuracy of coding. With the latter there are issues related to equity of treatment of different beneficiaries.

Another important issue for HCFA's consideration of future refinement of the RPPS is the coordination of payment across post acute sites. The MDS-PAC, if implemented in multiple types of facilities could provide information that would enable the payment system to better adjust for the needs of different patients —especially patients who are treated in multiple sites. It might also allow eventual integration of the payment systems for different types of facilities.

We shall lay out an agenda for payment related research on the MDS-PAC. We shall provide a detailed research plan that, if implemented, would allow HCFA to best utilize information from the MDS-PAC and other potential data sources to refine the RPPS. We shall make further recommendations to HCFA about implementing that plan.

10. MONITORING

We will develop options for monitoring the performance of the RPPS. Monitoring will describe changes in access to rehabilitation, in payments to rehabilitation facilities, in quality of care, and in cost of rehabilitation care. The system will identify unintended changes in the operation of the rehabilitation system and point out the need to refine the payment system.

Because the RPPS may have effects on other providers, and because changes in the payment systems for other providers may affect rehabilitation, the monitoring system will also describe changes in access, utilization, quality, and cost of care in different types of post-acute sites including home health and skilled nursing facilities.

The monitoring system will provide indicators of performance at the level of the individual rehabilitation facility, the rehabilitation market, the post acute care market, and the nation. The indicators for individual hospitals will point out hospitals that require attention because they may be coding incorrectly or may be providing lower quality care. Also, analyses of the distribution of these hospital indicators within specific classes of hospitals (e.g., teaching hospitals, rural hospitals, etc.) will show the adequacy of our facility level adjustments.

The market level indicators will show if there are flaws in the post acute system that show up only in certain circumstances —e.g., in heavy managed care markets, or when there is an exceptionally large or small supply of skilled nursing facilities. In order to define a market we will probably use MSA and group all the rural areas within each state. The collection of market level indicators may also demonstrate the adequacy (or inadequacy) of the area wage adjustment. The collection of market indicators will also show if post acute care is becoming more or less standardized across the country.

The recommendations for the design and implementation of the monitoring system will include specific rules for each indicator including the calculation formula(s), the source of each data element, and the level of the indicator (e.g., hospital vs. MSA). For hospital statistics, we will include a method to determine if changes in the indicator are statistically significant. We will also describe how the collection of indicators can be analyzed to produce a coherent description of changes that are occurring in post acute care. We will tabulate each indicator from our 1996 and 1997 MEDPAR files. This will provide baseline measures, as well as give us a sense of year to year variability.

In order to make the discussion a little concrete, we list here only a few possibilities out of the many possible indicators:

1) For each hospital and market: time series counts of total admissions to inpatient rehabilitation;

(2) For each market: the percent of acute discharges with a DRG of stroke who are admitted to inpatient rehabilitation, percent admitted to a SNF, and percent who receive HHA care within a short time from acute discharge;

(3) For each hospital and market: time series on the average LOS in inpatient rehabilitation,

(4) For each hospital and nationally: the case mix index and the distribution of cases by FRGC;

(5) The FIM motor score at discharge or the change in the motor score from admission to discharge; and

(6) Payment-to-cost ratios for groups of hospitals and patients.

Our design for the monitoring system will not only describe the indicators, it will also show how they can be used together to obtain a clear description of access, outcomes, and cost at inpatient rehabilitation and other post acute care facilities.

11. SCHEDULE AND DELIVERABLES

The BBA mandates the implementation of the RPPS for hospital fiscal years beginning on or after Oct. 1, 2000. Working backwards from this schedule and allowing for time intervals required before implementation of major payment changes, HCFA has determined that the Final Rule for the RPPS must be published by August 1, 2000 and the Notice of Proposed Rule Making must be published in December of 1999.

These dates drive the schedule for the portion of our research plan related to the design, development, and implementation of payment formula. We will begin immediately on all aspects of the actual payment system rather than proceeding sequentially. The logical progression of our work would be to first determine all elements of the classification system—i.e., the cut-off points for the FIM scores and age limits for each FRG and the construction of the comorbidity indicator(s). Then we would calculate weights for each FRGC and calculate each hospital's case mix index. The case mix index is required for analyses of facility payment adjustments. The weights are required for analyses of payment for transfers and outliers. All these elements are required for our simulations and for the impact analyses.

We do not have the luxury of this logical progression because of the impending deadlines. We are, however, fortunate that many of these steps have been already carried out on earlier data. Thus we have preliminary specifications for the classification system and the very first activity that we will complete is the evaluation of how well this system performs on the 1996 and 1997 data. This evaluation will be completed in early September 1999. We will then develop preliminary weights for these initial FRGCs —or for slight modifications of them as suggested by the evaluation. We will then use these weights to analyze the other payment elements while we simultaneously analyze and refine the FRGC classification system. After the classification system is finished, we will then repeat our analyses of each of the other payment elements.

Thus we will produce at least 2 analyses for each payment element – as a recommendation to HCFA for the NPRM and for the Final Rule.[14] The methodology will be identical in both cases, but the data may be more recent or more complete in the second case. For example, an audited version of the HCRIS PPS 14 file should be available for the Final rule and this could change our estimates of some case costs and of TEFRA payment. Also, the second analyses may reflect better estimates of the case mix at hospitals that did not contribute

[14] We actually expect that there will be three rounds of analysis, two for the NPRM. The first round will provide enough information to describe all policy decisions and the evidence for or against these decisions. The second round will provide numbers to be used in the NPRM.

to our FIM database. The FY 1998 MEDPAR could also be used to examine trends in the distribution of rehabilitation cases across facilities. Finally, the second analyses will more fully reflect the interactions among the payment elements. For example, using improved case cost estimates might result in a change in the facility payment regression coefficients and therefore a slight increase or decrease in payment for teaching hospitals.

An important difference between the two analyses is that the second analysis will reflect input from the Technical Expert Panel that we will convene to evaluate our interim report. This panel of experts in rehabilitation for the elderly, patient classification, and payment systems will include physicians, hospital managers, researchers and representatives of industry and professional societies. They will meet once to review our interim report and once to review a draft of our final report. Each meeting will be structured to elicit the maximum amount of information and will include presentations, moderated discussion sessions, and individual questionnaires.

The interim report will include analysis of the case mix at hospitals that did not contribute FIM data to our study. After completion of the interim report, we will turn to design of the monitoring system and developing refinements to the RPPS.

The schedule follows. The date for version 1 of the payment system is contingent on HCFA promptly providing all the data that we require for the analyses including facility information on teaching and disproportion share and TEFRA payment rates.

Schedule for Completion of Project Activities

Activity	Completion Date
Evaluation of earlier classification system	Sept. 1999
Version 1 of payment elements and coding changes	Oct. 1999
Improved case mix estimate for missing cases	Jan. 2000
Interim report	Feb. 17, 2000
TEP meeting on interim report	Feb. 2000
Final version of payment elements and coding changes	Mar. 2000
Monitoring system design and refinement plan	Nov. 2000
Draft final report	Nov. 2000
Second TEP meeting	Dec. 2000
Final final report	Jan. 17, 2001

APPENDIX: ICD-9-CM CODES FOR MAJOR COMORBIDITIES

ICD9	DESCRIPT
01160	TB PNEUMONIA-UNSPEC
01161	TB PNEUMONIA-NO EXAM
01162	TB PNEUMONIA-EXAM UNKN
01163	TB PNEUMONIA-MICRO DX
01164	TB PNEUMONIA-CULT DX
01165	TB PNEUMONIA-HISTO DX
01166	TB PNEUMONIA-OTH TEST
01170	TB PNEUMOTHORAX-UNSPEC
01171	TB PNEUMOTHORAX-NO EXAM
01172	TB PNEUMOTHORX-EXAM UNKN
01173	TB PNEUMOTHORAX-MICRO DX
01174	TB PNEUMOTHORAX-CULT DX
01175	TB PNEUMOTHORAX-HISTO DX
01176	TB PNEUMOTHORAX-OTH TEST
01300	TB MENINGITIS-UNSPEC
01301	TB MENINGITIS-NO EXAM
01302	TB MENINGITIS-EXAM UNKN
01303	TB MENINGITIS-MICRO DX
01304	TB MENINGITIS-CULT DX
01305	TB MENINGITIS-HISTO DX
01306	TB MENINGITIS-OTH TEST
01310	TUBRCLMA MENINGES-UNSPEC
01311	TUBRCLMA MENING-NO EXAM
01312	TUBRCLMA MENIN-EXAM UNKN
01313	TUBRCLMA MENING-MICRO DX
01314	TUBRCLMA MENING-CULT DX
01315	TUBRCLMA MENING-HISTO DX
01316	TUBRCLMA MENING-OTH TEST
01320	TUBERCULOMA BRAIN-UNSPEC
01321	TUBRCLOMA BRAIN-NO EXAM
01322	TUBRCLMA BRAIN-EXAM UNKN
01323	TUBRCLOMA BRAIN-MICRO DX
01324	TUBRCLOMA BRAIN-CULT DX
01325	TUBRCLOMA BRAIN-HISTO DX
01326	TUBRCLOMA BRAIN-OTH TEST
01330	TB BRAIN ABSCESS-UNSPEC
01331	TB BRAIN ABSCESS-NO EXAM
01332	TB BRAIN ABSC-EXAM UNKN
01333	TB BRAIN ABSC-MICRO DX
01334	TB BRAIN ABSCESS-CULT DX
01335	TB BRAIN ABSC-HISTO DX
01336	TB BRAIN ABSC-OTH TEST
01350	TB SP CRD ABSCESS-UNSPEC
01351	TB SP CRD ABSC-NO EXAM
01352	TB SP CRD ABSC-EXAM UNKN
01353	TB SP CRD ABSC-MICRO DX
01354	TB SP CRD ABSC-CULT DX

01355	TB SP CRD ABSC-HISTO DX
01356	TB SP CRD ABSC-OTH TEST
01400	TB PERITONITIS-UNSPEC
01401	TB PERITONITIS-NO EXAM
01402	TB PERITONITIS-EXAM UNKN
01403	TB PERITONITIS-MICRO DX
01404	TB PERITONITIS-CULT DX
01405	TB PERITONITIS-HISTO DX
01406	TB PERITONITIS-OTH TEST
0360	MENINGOCOCCAL MENINGITIS
0362	MENINGOCOCCEMIA
0363	MENINGOCOCC ADRENAL SYND
03640	MENINGOCOCC CARDITIS NOS
03642	MENINGOCOCC ENDOCARDITIS
03643	MENINGOCOCC MYOCARDITIS
037	TETANUS
0380	STREPTOCOCCAL SEPTICEMIA
0381	STAPHYLOCOCC SEPTICEMIA
03810	Staphyloccal septicemia, unspecified
03811	Staphyloccal aureus septicemia
03819	Other staphyloccal septicemia
0382	PNEUMOCOCCAL SEPTICEMIA
0383	ANAEROBIC SEPTICEMIA
03840	GRAM-NEG SEPTICEMIA NOS
03841	H. INFLUENAE SEPTICEMIA
03842	E COLI SEPTICEMIA
03843	PSEUDOMONAS SEPTICEMIA
03844	SERRATIA SEPTICEMIA
03849	GRAM-NEG SEPTICEMIA NEC
0388	SEPTICEMIA NEC
0389	SEPTICEMIA NOS
0520	POSTVARICELLA ENCEPHALIT
0521	VARICELLA PNEUMONITIS
0530	HERPES ZOSTER MENINGITIS
0543	HERPETIC ENCEPHALITIS
0545	HERPETIC SEPTICEMIA
05472	H SIMPLEX MENINGITIS
05479	H SIMPLEX COMPLICAT NEC
0550	POSTMEASLES ENCEPHALITIS
0551	POSTMEASLES PNEUMONIA
07020	VRL HEPAT B CM W/O DELTA
07021	VRL HEPAT B CM W DELTA
07022	Chonic viral Hep B with hepatic coma, wo mention of hepatitis delta
07023	Chonic viral Hep B with hepatic coma, with hepatitis delta
07041	SPF VRL HPT CM HPT C
07042	SPF VRL HPT CM DLT W/O B
07043	SPF VRL HPT CM HPT E
07044	Chronic hepatitis C with hepatic coma
07049	SPF VRL HPT CM
0706	VIRAL HEPAT NOS W COMA
0721	MUMPS MENINGITIS
0722	MUMPS ENCEPHALITIS
0723	MUMPS PANCREATITIS

09042	CONGEN SYPH MENINGITIS
09320	SYPHIL ENDOCARDITIS NOS
09382	SYPHILITIC MYOCARDITIS
0942	SYPHILITIC MENINGITIS
09487	SYPH RUPT CEREB ANEURYSM
1124	CANDIDIASIS OF LUNG
1125	DISSEMINATED CANDIDIASIS
11281	CANDIDAL ENDOCARDITIS
11283	CANDIDAL MENINGITIS
1142	COCCIDIOIDAL MENINGITIS
11501	HISTOPLASM CAPSUL MENING
11504	HISTOPLASM CAPS ENDOCARD
11505	HISTOPLASM CAPS PNEUMON
11511	HISTOPLASM DUBOIS MENING
11514	HISTOPLASM DUB ENDOCARD
11515	HISTOPLASM DUB PNEUMONIA
11591	HISTOPLASMOSIS MENINGIT
11594	HISTOPLASMOSIS ENDOCARD
11595	HISTOPLASMOSIS PNEUMONIA
1300	TOXOPLASM MENINGOENCEPH
1303	TOXOPLASMA MYOCARDITIS
1304	TOXOPLASMA PNEUMONITIS
1363	PNEUMOCYSTOSIS
20400	ACT LYM LEUK W/O RMSION
20500	ACT MYL LEUK W/O RMSION
20600	ACT MONO LEUK W/O RMSION
20700	ACT ERTH/ERYLK W/O RMSON
20800	ACT LEUK UNS CL W/O RMSN
260	KWASHIORKOR
261	NUTRITIONAL MARASMUS
262	OTH SEVERE MALNUTRITION
2638	PROTEIN-CAL MALNUTR NEC
27700	CYSTIC FIBROS W/O ILEUS
27701	CYSTIC FIBROSIS W ILEUS
2860	CONG FACTOR VIII DIORD
2861	CONG FACTOR IX DISORDER
2866	DEFIBRINATION SYNDROME
3200	HEMOPHILUS MENINGITIS
3201	PNEUMOCOCCAL MENINGITIS
3202	STREPTOCOCCAL MENINGITIS
3203	STAPHYLOCOCC MENINGITIS
3207	MENING IN OTH BACT DIS
32081	ANAEROBIC MENINGITIS
32082	MNINGTS GRAM-NEG BCT NEC
32089	MENINGITIS OTH SPCF BACT
3209	BACTERIAL MENINGITIS NOS
3210	CRYPTOCOCCAL MENINGITIS
3211	MENING IN OTH FUNGAL DIS
3214	MENINGIT D/T SARCOIDOSIS
3218	MENING IN OTH NONBAC DIS
3240	INTRACRANIAL ABSCESS
3241	INTRASPINAL ABSCESS
3249	CNS ABSCESS NOS

34511	GEN CNV EPIL W INTR EPIL
3453	GRAND MAL STATUS
3481	ANOXIC BRAIN DAMAGE
34982	TOXIC ENCEPHALOPATHY
3980	RHEUMATIC MYOCARDITIS
40403	MAL HYP HRT/REN W CHF&RF
41001	AMI ANTEROLATERAL, INIT
41011	AMI ANTERIOR WALL, INIT
41021	AMI INFEROLATERAL, INIT
41031	AMI INFEROPOST, INITIAL
41041	AMI INFERIOR WALL, INIT
41051	AMI LATERAL NEC, INITIAL
41061	TRUE POST INFARCT, INIT
41071	SUBENDO INFARCT, INITIAL
41081	AMI NEC, INITIAL
41091	AMI NOS, INITIAL
4151	PULMON EMBOLISM/INFARCT
41511	Iatrogenic pulmaonary embolism and infarction
41519	Other pulmaonary embolism and infarction
4210	AC/SUBAC BACT ENDOCARD
4211	AC ENDOCARDIT IN OTH DIS
4219	AC/SUBAC ENDOCARDIT NOS
4220	AC MYOCARDIT IN OTH DIS
42290	ACUTE MYOCARDITIS NOS
42291	IDIOPATHIC MYOCARDITIS
42292	SEPTIC MYOCARDITIS
42293	TOXIC MYOCARDITIS
42299	ACUTE MYOCARDITIS NEC
42741	VENTRICULAR FIBRILLATION
4275	CARDIAC ARREST
430	SUBARACHNOID HEMORRHAGE
431	INTRACEREBRAL HEMORRHAGE
4320	NONTRAUM EXTRADURAL HEM
4321	SUBDURAL HEMORRHAGE
43301	OCL BSLR ART W INFRCT
43311	OCL CRTD ART W INFRCT
43321	OCL VRTB ART W INFRCT
43331	OCL MLT BI ART W INFRCT
43381	OCL SPCF ART W INFRCT
43391	OCL ART NOS W INFRCT
43401	CRBL THRMBS W INFRCT
43411	CRBL EMBLSM W INFRCT
43491	CRBL ART OCL NOS W INFRC
436	CVA
4410	DISSECTING ANEURYSM
44100	Dissecting aortic aneurysm of usnpecified site
44101	Dissecting thoracic aortic aneurysm
44102	Dissecting abdominal aortic aneurysm
44103	Dissecting thoracabdominal aortic aneurysm
4411	RUPTUR THORACIC ANEURYSM
4413	RUPT ABD AORTIC ANEURYSM
4415	RUPT AORTIC ANEURYSM NOS
4416	THORACOABD ANEURYSM RUPT

4463	LETHAL MIDLINE GRANULOMA
452	PORTAL VEIN THROMBOSIS
4530	BUDD-CHIARI SYNDROME
4532	VENA CAVA THROMBOSIS
4533	RENAL VEIN THROMBOSIS
46411	AC TRACHEITIS W OBSTRUCT
46421	AC LARYNGOTRACH W OBSTR
46431	AC EPIGLOTTITIS W OBSTR
481	PNEUMOCOCCAL PNEUMONIA
4820	K. PNEUMONIAE PNEUMONIA
4821	PSEUDOMONAL PNEUMONIA
4822	H.INFLUENZAE PNEUMONIA
48230	STREPTOCOCCAL PNEUMN NOS
48231	PNEUMONIA STRPTOCOCCUS A
48232	PNEUMONIA STRPTOCOCCUS B
48239	PNEUMONIA OTH STREP
4824	STAPHYLOCOCCAL PNEUMONIA
48281	PNEUMONIA ANAEROBES
48282	PNEUMONIA E COLI
48283	PNEUMO OTH GRM-NEG BACT
48284	Legionaires disease
48289	PNEUMONIA OTH SPCF BACT
4829	BACTERIAL PNEUMONIA NOS
4830	PNEU MYCPLSM PNEUMONIAE
4838	PNEUMON OTH SPEC ORGNSM
4841	PNEUM W CYTOMEG INCL DIS
4843	PNEUMONIA IN WHOOP COUGH
4845	PNEUMONIA IN ANTHRAX
4846	PNEUM IN ASPERGILLOSIS
4847	PNEUM IN OTH SYS MYCOSES
4848	PNEUM IN INFECT DIS NEC
485	BRONCHOPNEUMONIA ORG NOS
486	PNEUMONIA, ORGANISM NOS
4870	INFLUENZA WITH PNEUMONIA
5061	FUM/VAPOR AC PULM EDEMA
5070	FOOD/VOMIT PNEUMONITIS
5071	OIL/ESSENCE PNEUMONITIS
5078	SOLID/LIQ PNEUMONIT NEC
5100	EMPYEMA WITH FISTULA
5109	EMPYEMA W/O FISTULA
5111	BACT PLEUR/EFFUS NOT TB
5130	ABSCESS OF LUNG
5131	ABSCESS OF MEDIASTINUM
5185	POST TRAUM PULM INSUFFIC
51881	RESPIRATORY FAILURE
5192	MEDIASTINITIS
5304	PERFORATION OF ESOPHAGUS
53082	ESOPHAGEAL HEMORRHAGE
53100	AC STOMACH ULCER W HEM
53101	AC STOMAC ULC W HEM-OBST
53110	AC STOMACH ULCER W PERF
53111	AC STOM ULC W PERF-OBST
53120	AC STOMAC ULC W HEM/PERF

53121	AC STOM ULC HEM/PERF-OBS
53140	CHR STOMACH ULC W HEM
53141	CHR STOM ULC W HEM-OBSTR
53150	CHR STOMACH ULCER W PERF
53151	CHR STOM ULC W PERF-OBST
53160	CHR STOMACH ULC HEM/PERF
53161	CHR STOM ULC HEM/PERF-OB
53200	AC DUODENAL ULCER W HEM
53201	AC DUODEN ULC W HEM-OBST
53210	AC DUODENAL ULCER W PERF
53211	AC DUODEN ULC PERF-OBSTR
53220	AC DUODEN ULC W HEM/PERF
53221	AC DUOD ULC HEM/PERF-OBS
53240	CHR DUODEN ULCER W HEM
53241	CHR DUODEN ULC HEM-OBSTR
53250	CHR DUODEN ULCER W PERF
53251	CHR DUODEN ULC PERF-OBST
53260	CHR DUODEN ULC HEM/PERF
53261	CHR DUOD ULC HEM/PERF-OB
53300	AC PEPTIC ULCER W HEMORR
53301	AC PEPTIC ULC W HEM-OBST
53310	AC PEPTIC ULCER W PERFOR
53311	AC PEPTIC ULC W PERF-OBS
53320	AC PEPTIC ULC W HEM/PERF
53321	AC PEPT ULC HEM/PERF-OBS
53340	CHR PEPTIC ULCER W HEM
53341	CHR PEPTIC ULC W HEM-OBS
53350	CHR PEPTIC ULCER W PERF
53351	CHR PEPTIC ULC PERF-OBST
53360	CHR PEPT ULC W HEM/PERF
53361	CHR PEPT ULC HEM/PERF-OB
53400	AC MARGINAL ULCER W HEM
53401	AC MARGIN ULC W HEM-OBST
53410	AC MARGINAL ULCER W PERF
53411	AC MARGIN ULC W PERF-OBS
53420	AC MARGIN ULC W HEM/PERF
53421	AC MARG ULC HEM/PERF-OBS
53440	CHR MARGINAL ULCER W HEM
53441	CHR MARGIN ULC W HEM-OBS
53450	CHR MARGINAL ULC W PERF
53451	CHR MARGIN ULC PERF-OBST
53460	CHR MARGIN ULC HEM/PERF
53461	CHR MARG ULC HEM/PERF-OB
53501	ACUTE GASTRITIS W HMRHG
53511	ATRPH GASTRITIS W HMRHG
53521	GSTR MCSL HYPRT W HMRG
53531	ALCHL GSTRITIS W HMRHG
53541	OTH SPF GASTRT W HMRHG
53551	GSTR/DDNTS NOS W HMRHG
53561	DUODENITIS W HMRHG
5374	GASTRIC/DUODENAL FISTULA
53783	ANGIO STM/DUDN W HMRHG
5400	AC APPEND W PERITONITIS

5570	AC VASC INSUFF INTESTINE
56202	DVRTCLO SML INT W HMRHG
56203	DVRTCLI SML INT W HMRHG
56212	DVRTCLO COLON W HMRHG
56213	DVRTCLI COLON W HMRHG
5670	PERITONITIS IN INFEC DIS
5671	PNEUMOCOCCAL PERITONITIS
5672	SUPPURAT PERITONITIS NEC
5678	PERITONITIS NEC
5679	PERITONITIS NOS
56983	PERFORATION OF INTESTINE
56985	ANGIO INTES W HMRHG
570	ACUTE NECROSIS OF LIVER
5720	ABSCESS OF LIVER
5724	HEPATORENAL SYNDROME
5734	HEPATIC INFARCTION
5754	PERFORATION GALLBLADDER
5763	PERFORATION OF BILE DUCT
5772	PANCREAT CYST/PSEUDOCYST
5800	AC PROLIFERAT NEPHRITIS
5804	AC RAPIDLY PROGR NEPHRIT
58081	AC NEPHRITIS IN OTH DIS
58089	ACUTE NEPHRITIS NEC
5809	ACUTE NEPHRITIS NOS
5834	RAPIDLY PROG NEPHRIT NOS
5845	LOWER NEPHRON NEPHROSIS
5846	AC RENAL FAIL, CORT NECR
5847	AC REN FAIL, MEDULL NECR
5848	AC RENAL FAILURE NEC
5849	ACUTE RENAL FAILURE NOS
5902	RENAL/PERIRENAL ABSCESS
5966	BLADDER RUPT, NONTRAUM
65930	SEPTICEMIA IN LABOR-UNSP
65931	SEPTICEM IN LABOR-DELIV
66500	PRELABOR RUPT UTER-UNSP
66501	PRELABOR RUPT UTERUS-DEL
66503	PRELAB RUPT UTER-ANTEPAR
66510	RUPTURE UTERUS NOS-UNSP
66511	RUPTURE UTERUS NOS-DELIV
66910	OBSTETRIC SHOCK-UNSPEC
66911	OBSTETRIC SHOCK-DELIVER
66912	OBSTET SHOCK-DELIV W P/P
66913	OBSTETRIC SHOCK-ANTEPAR
66914	OBSTETRIC SHOCK-POSTPART
66930	AC REN FAIL W DELIV-UNSP
66932	AC REN FAIL-DELIV W P/P
66934	AC RENAL FAILURE-POSTPAR
67300	OB AIR EMBOLISM-UNSPEC
67301	OB AIR EMBOLISM-DELIVER
67302	OB AIR EMBOL-DELIV W P/P
67303	OB AIR EMBOLISM-ANTEPART
67304	OB AIR EMBOLISM-POSTPART
67310	AMNIOTIC EMBOLISM-UNSPEC

67311	AMNIOTIC EMBOLISM-DELIV
67312	AMNIOT EMBOL-DELIV W P/P
67313	AMNIOTIC EMBOL-ANTEPART
67314	AMNIOTIC EMBOL-POSTPART
67320	OB PULM EMBOL NOS-UNSPEC
67322	PULM EMBOL NOS-DEL W P/P
67323	PULM EMBOL NOS-ANTEPART
67324	PULM EMBOL NOS-POSTPART
67330	OB PYEMIC EMBOL-UNSPEC
67331	OB PYEMIC EMBOL-DELIVER
67332	OB PYEM EMBOL-DEL W P/P
67333	OB PYEMIC EMBOL-ANTEPART
67334	OB PYEMIC EMBOL-POSTPART
67380	OB PULMON EMBOL NEC-UNSP
67381	PULMON EMBOL NEC-DELIVER
67382	PULM EMBOL NEC-DEL W P/P
67383	PULMON EMBOL NEC-ANTEPAR
67384	PULMON EMBOL NEC-POSTPAR
67400	PUERP CEREBVASC DIS-UNSP
7070	DECUBITUS ULCER
76501	EXTREME IMMATUR <500G
76502	EXTREME IMMATUR 500-749G
76503	EXTREME IMMATUR 750-999G
7817	TETANY
78551	CARDIOGENIC SHOCK
78559	SHOCK W/O TRAUMA NEC
7991	RESPIRATORY ARREST
9580	AIR EMBOLISM
9581	FAT EMBOLISM
9585	TRAUMATIC ANURIA
99602	MALFUNC PROSTH HRT VALVE
99661	REACT-CARDIAC DEV/GRAFT
99662	REACT-OTH VASC DEV/GRAFT
99663	REACT-NERV SYS DEV/GRAFT
99666	REACT-INTER JOINT PROST
99667	REACT-OTH INT ORTHO DEV
99669	REACT-INT PROS DEVIC NEC
99762	INFECTION AMPUTAT STUMP
9980	POSTOPERATIVE SHOCK
9983	POSTOP WOUND DISRUPTION
9986	PERSIST POSTOP FISTULA
9991	AIR EMBOL COMP MED CARE
V461	DEPENDENCE ON RESPIRATOR

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